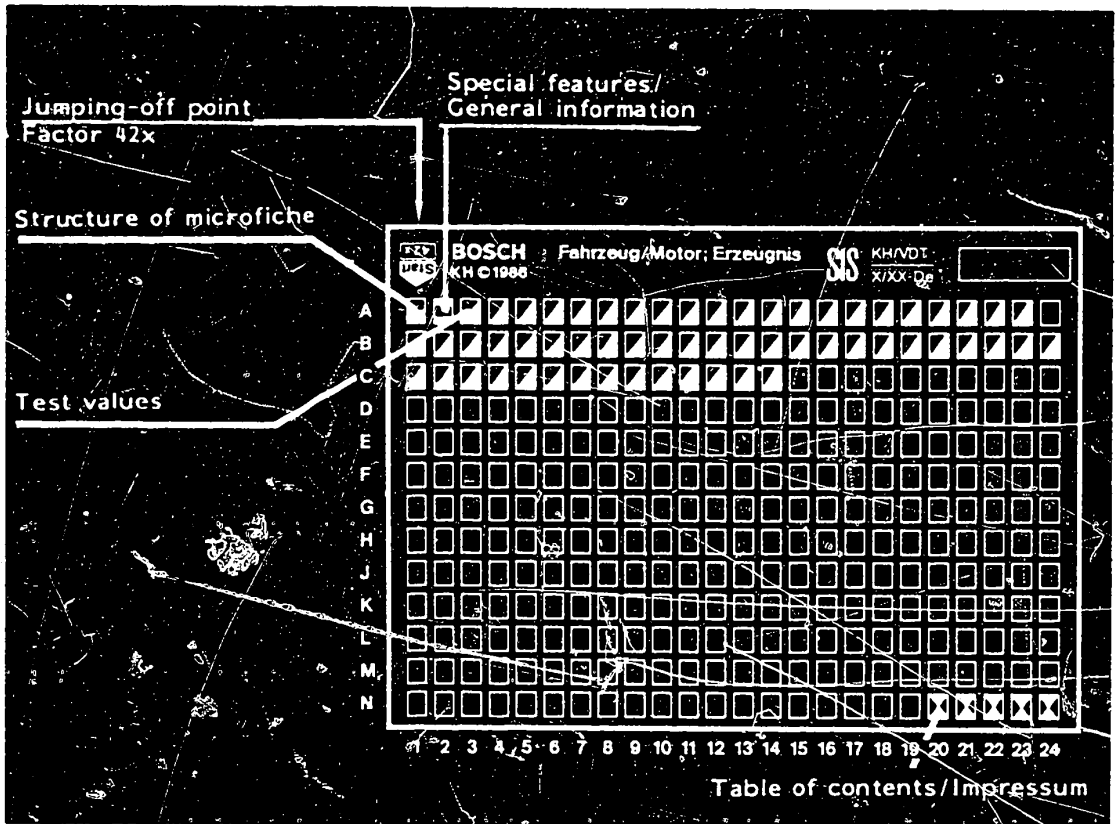


Structure of microfiche



1. Read from left to right
2. Title of microfiche (appears on each coordinate)

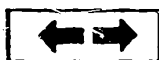
E 16	Product/assembly/test step	
	Vehicle/engine	

Coordinate

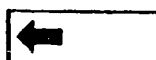
3. Limits of section



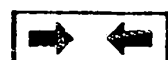
Beginning



Mid-section



End



One-page section

A1

Test specifications



1. Special features

This microcard contains test specifications for starting motors (0 001 ...). The output information in kW refers to the maximum permitted vehicle battery size, 3/4 charged.

The part numbers of the starting motors are initially arranged in rising numerical order. They are listed later in unsorted sequence.

The desired starting motors and their test specifications can now be found only with the revised microcard "STARTING MOTORS - Listing of test specifications "W-001/1000

2. General information

The test specifications listed in this microcard refer to testing with 2 x 143 Ah batteries (parallel connected).

The batteries used for testing must be 3/4 charged.

Use the most suitable clamping flange for testing starting motors.

If no suitable clamping flange is available, an available clamping flange must be adapted to the starting motor.

Test benches used: EFAL 140
EFAL 152/153
KPS 002

A2

General information

Starting motor 0 001 ..



In order to prevent damage to smaller starting motors in testing, such starters are tested using a series resistor of 10 mΩ.

Connection term. 30/2 on test bench EFAL 152/153 or separate series resistor, part no. 1 684 530 100

Torque information only with test benches having torque-measuring device.

Further information:

Starting-motor repair instructions, motor-vehicle electric specifications.

A3

General information

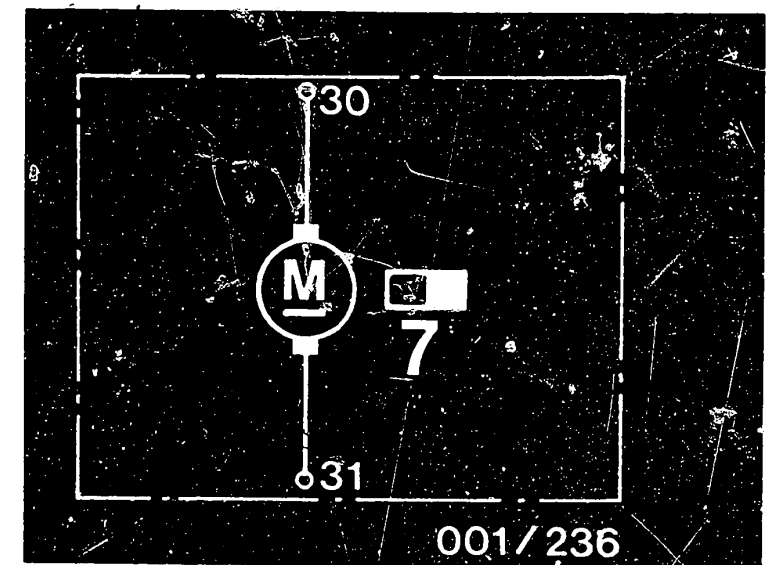
Starting motor 0 001 ..



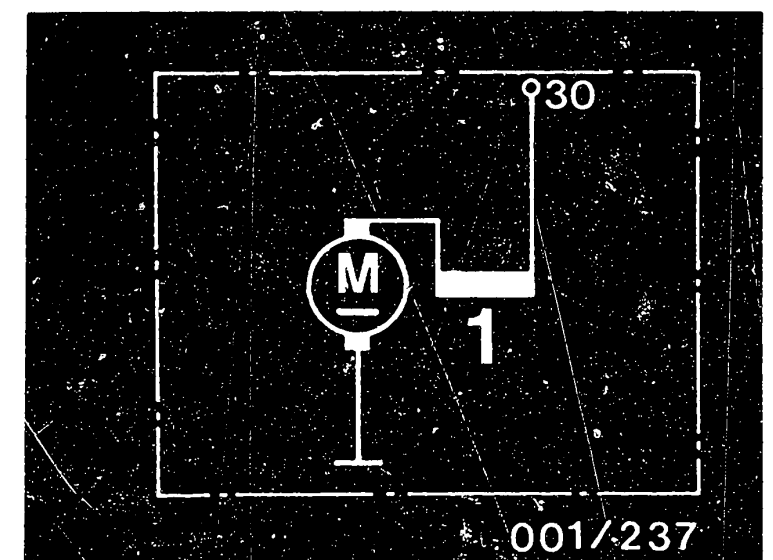
Part no.		0 001 000 .. 050 ..	0 001 001 ..	0 001 100 ..	0 001 101 ..		
Previous type code		CB 12V 0.15 kW	CB 12V 0.3 kW	CD 0.3/6	CD 0.4/6		
Idle	V	12	12	5.5	5.5		
	< A	7	50	65	70		
	> min ⁻¹	4200	9500	6000	6000		
Short circuit ¹⁾	V	8	6	3	2.5	2.5	2
	A	60 ... 75	200 ... 250	250 ... 340	200 ... 290	270 ... 360	210 ... 290
Torque	> Nm	-	-	2.9	2.4	3.8	3.0
Minimum voltage for solenoid switch	V	-	-	-	-		
Commutator dia.		23	23			33	
	new mm minimum mm						31.2
Brush press.	N	1.8...2.2	3.8...5.4			5.5...7.0	
Carbon-brush minimum length	mm	7.5	5			11.5	
Setting "a" relay	mm	-	-			-	
Burn-off reserve	mm	-	-			1	
Armature longitudinal clearance	mm	0.1 ... 0.3	0.05 ... 0.2			0.05...0.3	
Armature braking torque	Nm	0.02 ... 0.03	0.05 ... 0.1			0.24...0.4	
Overrunning torque, overrunning clutch	Nm	-	0.14 ... 0.22			0.06...0.1 ¹⁾ 0.14...0.22 ²⁾	
Backlash of teeth	mm	approx 0.2	0.3 ... 0.6			0.3 ... 0.6	
Pinion clearance	mm	1.5 ... 2.5	1.5 ... 2.5			2.0 ... 3.0	

1) Inner overrunning-clutch drive

2) Outer overrunning-clutch drive



1 = Series winding
7 = Permanent magnet



A4

Test specifications

Starting motor 0 001 ..



A5

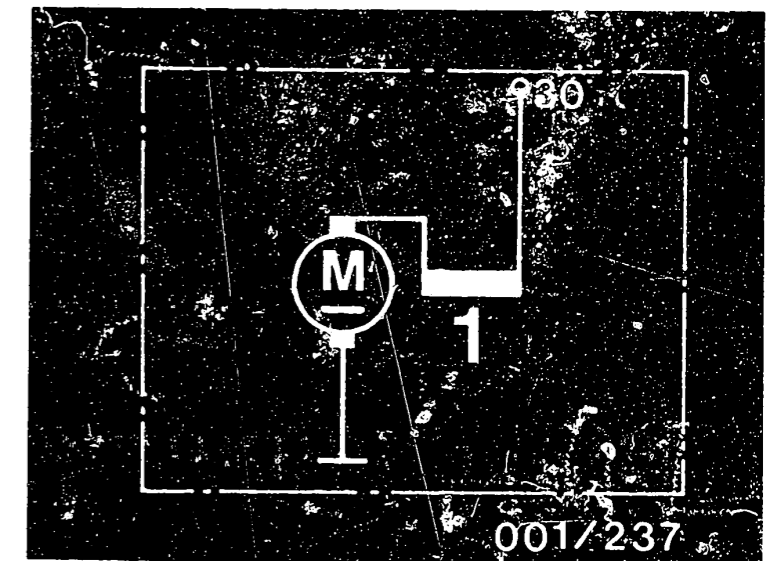
Test specifications

Starting motor 0 001 ..

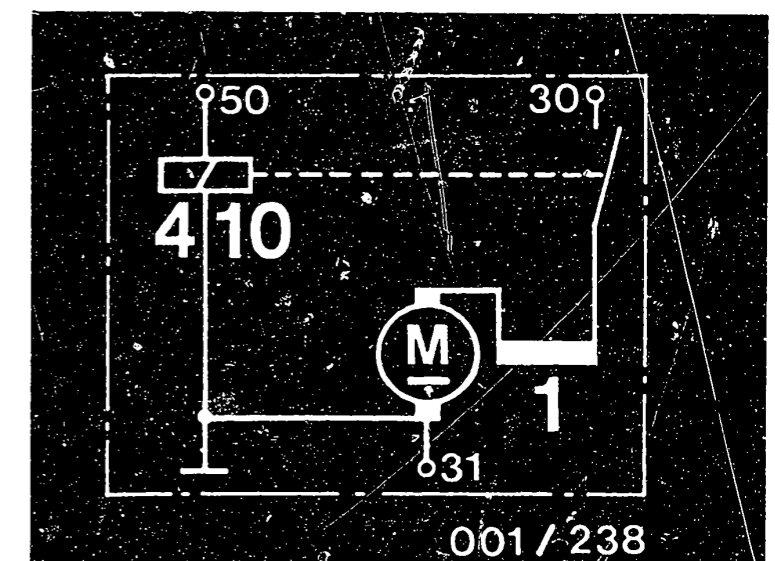


Part no.		0 001 102 ..	0 001 103 ..	0 001 104 ..			
Previous type code		CD 0.5/12	DD 6V 0.3 kW	DD 6 V 0.4 kW			
Idle	V	11.5	5.5	5.5			
	< A	40	85	65			
	> min ⁻¹	6500	6000	7000			
Short circuit	V	9	8	3.5	3	3.5	3
	A	260...	220...	280...	230...	370...	310...
Torque	> Nm	8.8	7.8	3.7	3.2	5.7	4.9
	Minimum voltage for solenoid switch	V	-	3.5	3.5		
Commutator dia.	new mm		33				
	minimum mm		31.2				
Brush press.	N		5.5 ... 7.0				
Carbon-brush minimum length	mm		11.5				
Setting "a" relay	mm	-	26.7 ± 0.1				
Burn-off reserve	mm		1				
Armature longitudinal clearance	mm		0.05 ... 0.3				
Armature braking torque	Nm		0.24 ... 0.4				
Overrunning torque, overrunning clutch	Nm		0.06...0.1 ¹⁾				
Backlash of teeth	mm		0.14...0.22 ²⁾				
Pinion clearance	mm		0.3 ... 0.6				
			2.0 ... 3.0				

- 1) Inner overrunning-clutch drive
2) Outer overrunning-clutch drive



- 1 = Series winding
4 = Holding winding
10 = Solenoid switch with/without insulated terminal 31



A6

Test specifications

Starting motor 0 001 ..



A7

Test specifications

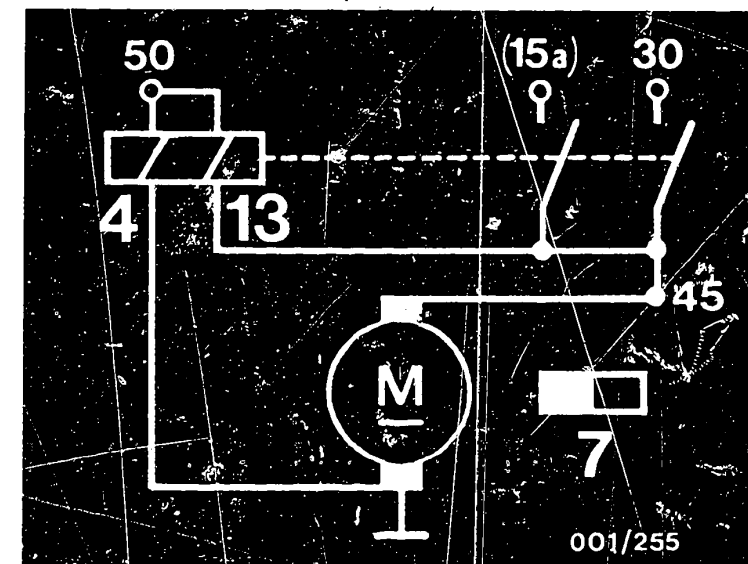
Starting motor 0 001 ..



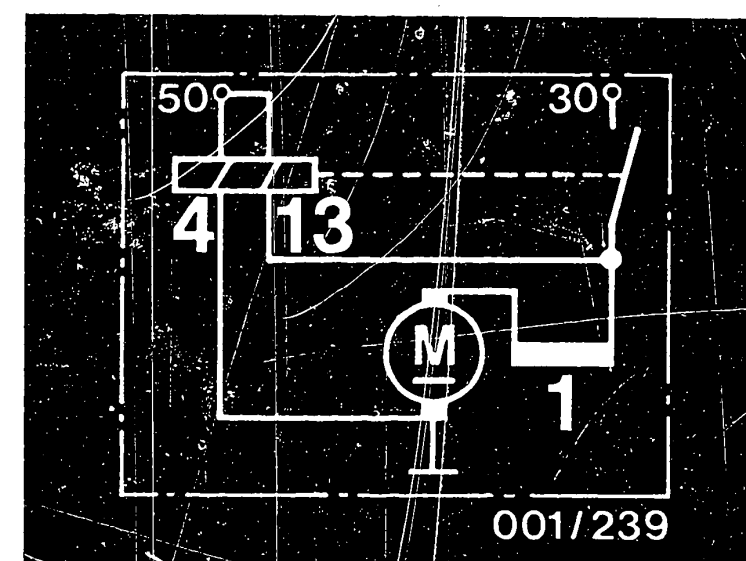
Part no.		0 001 108 .. 3	0 001 110 .. 3)	0 001 154 ..	0 001 155				
Previous type code		DW 12V 1.4 kW	DW 12V 1.7 kW	DD 6V 0.4 kW	DD 12V 0.5 k				
Idle	V	11.5	11.2	5.5	11.5				
	< A	75	95	65	40				
	> min ⁻¹	2900	2800	7000	6500				
Short circuit	V	3.5	4.5	3.8	3	3.5	3	9	8
	A	475...	625...	650...	510...	370...	310...	260...	230...
		600	800	840	660	470	400	340	310
Torque	> Nm	12.5	16	17.5	14	5.7	4.9	8.8	7.8
Minimum voltage for solenoid switch	V	8	8	3.5	8.0				
Commutator dia.									
	new mm	32.3	32.3	33	33				
	minimum mm	31.2	31.2	31.2	31.2				
Brush press.	N	-	-	8.0 ... 9.0	8.0 ... 9.0				
Carbon-brush minimum length	mm	4.5	6.0	11.5	11.5				
Setting "a" relay	mm	-	-	39 ± 0.1	37 ± 0.1				
Burn-off reserve	mm	-	-	0.9 ... 1.5	0.7 ... 1.5				
Armature longitudinal clearance	mm	0.05 ... 0.4	0.05 ... 0.4	0.1 ... 0.3	0.1 ... 0.3				
Armature braking torque	Nm	0.9 ... 1.4	0.9 ... 1.5	0.24 ... 0.4	0.24 ... 0.4				
Overrunning torque, overrunning clutch	Nm	0.12 ... 0.18	0.12 ... 0.18	0.06...0.11)	0.14 ... 0.22)				
Backlash of teeth	mm	0.3 ... 0.6	0.3 ... 0.6	0.3 ... 0.5	0.3 ... 0.6				
Pinion clearance	mm	2.0 ... 3.0	2.0 ... 3.0	2.0 ... 3.0	2.0 ... 3.0				

1) Inner overrunning-clutch drive
2) Outer overrunning-clutch drive

3) Testing only with 10 mΩ series resistor. **Note:**
Do not operate 12 V starting motor (DW) with 24 V;
starting motor would be destroyed.



1 = Series winding
4 = Holding winding
7 = Permanent magnet
13 = Pull-in winding



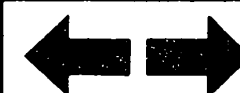
A8

Test specifications
Starting motor 0 001 ..



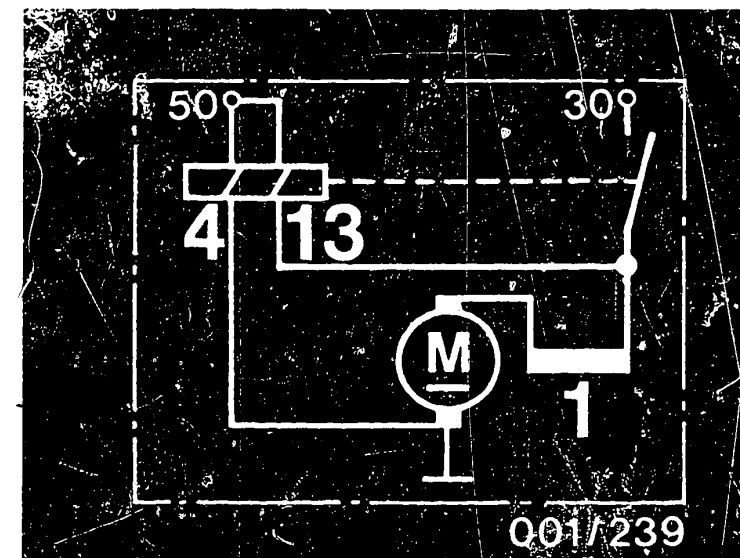
A9

Test specifications
Starting motor 0 001 ..

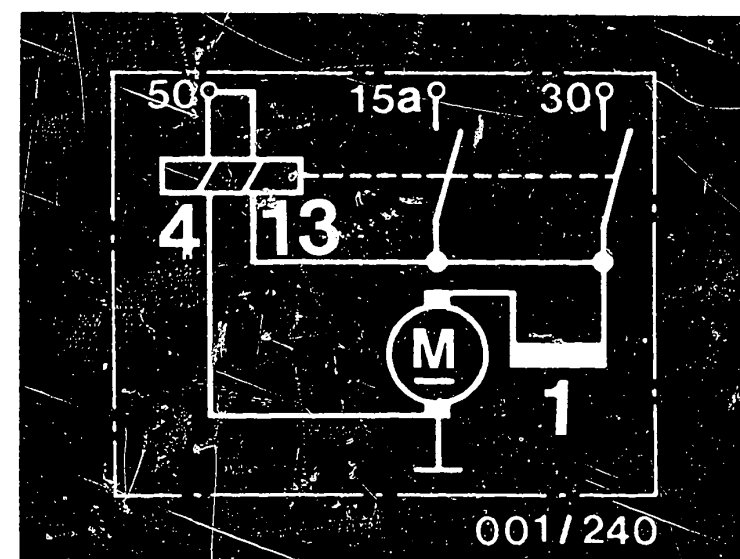


Part no.		0 001 157 001 up to 009	0 001 157 012 up to 024	0 001 157 022	0 001 158 ..				
Previous type code		DF 12V 0.6 kW	DF 12V 0.7 kW	DF 12V 0.6 kW	DD 12V 0.4 kW				
Idle	V	11.5	11.5	11.5	11.5				
	< A	40	50	50	55				
	> min ⁻¹	6500	7500	8000	9000				
Short circuit	V	8	7	8	7	8	7		
	A	345... 425	300... 380	380... 460	325... 400	290... 360	260... 330	320... 410	270... 360
Torque	> Nm	9.95	8.74	10	8.6	7.3	6.4	8.0	7.0
Minimum voltage for solenoid switch	V			8.0				8.0	
Commutator dia.	new mm			33				32.7	
	minimum mm			31.2				31.2	
Brush press.	N			8.0 ... 9.0 (14.5...16.0)				8.0 ... 9.0	
Carbon-brush minimum length	mm			11.5				11.5	
Setting "a" relay	mm			12 ± 0.1 (17.5 ± 0.15)				37 ± 0.1	
Burn-off reserve	mm			0.7 ... 1.5				0.9 ... 1.5	
Armature longitudinal clearance	mm			0.05 ... 0.3				0.1 ... 0.3	
Armature braking torque	Nm			0.24 ... 0.4				0.24 ... 0.4	
Overrunning torque, overrunning clutch	Nm			0.14 ... 0.22				0.14 ... 0.22	
Backlash of teeth	mm			0.3 ... 0.6				0.3 ... 0.6	
Pinion clearance	mm			2.0 ... 3.0				2.0 ... 3.0	

Values in parentheses apply only to 0 001 157 009; .. 012, .. 013



1 = Series winding
4 = Holding winding
13 = Pull-in winding



A10

Test specifications
Starting motor 0 001 ..

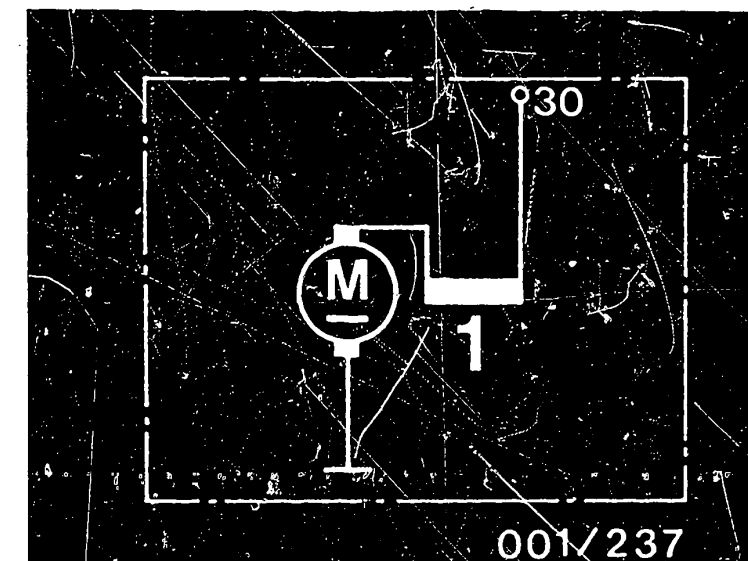


A11

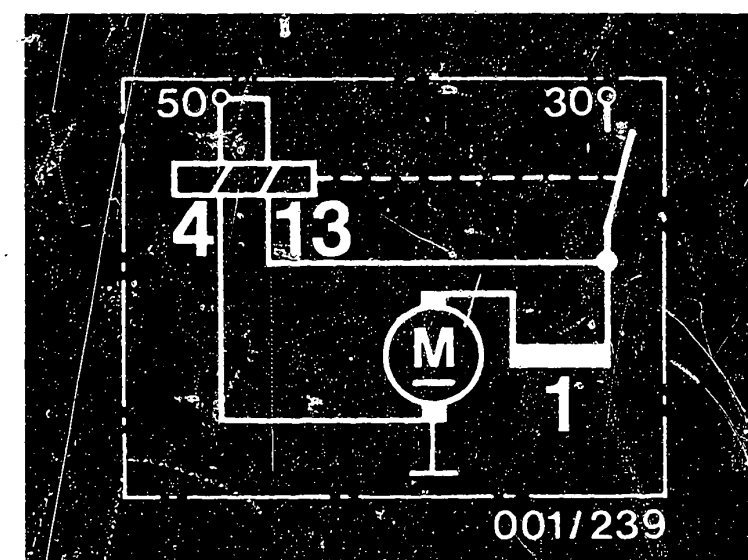
Test specifications
Starting motor 0 001 ..



Part no.		0 001 160 ..	0 001 201 ..	0 001 203 ..	0 001 203 ..				
				(with 4 carbon brushes)	(with 5 carbon brushes)				
Previous type code		ED 12V 0.65 kW	ED 6V 0.4 kW	E 12 V 0.8 kW					
Idle	V	11.5	5.5	11.5	11.5				
	< A	55	75	50	50				
	> min ⁻¹	9000	5500	5800	4500				
Short circuit	V	8.5	7.5	3	2.5	9	8	9	8
	A	340...	300...	300...	240...	290...	250...	330...	290...
Torque	> Nm	8.0	7.0	5.5	4.5	13.5	12	13.5	12
		430	390	390	330	380	340	420	380
Minimum voltage for solenoid switch	V	8.0	3.5	8.0	8.0				
Commutator dia.	new mm	32.7		36					
	minimum mm	31.2		33.5					
Brush press.	N	14.5 ... 15.0		8 ... 9					
Carbon-brush minimum length	mm	11.5		17					
Setting "a" relay	mm	-		32.2 ± 0.1					
Burn-off reserve	mm	-		0.9 ... 1.5					
Armature longitudinal clearance	mm	0.05 ... 0.2		0.1 ... 0.3					
Armature braking torque	Nm	0.12 ... 0.17		0.3 ... 0.6					
Overrunning torque, overrunning clutch	Nm	0.14 ... 0.22		0.06 ... 0.1					
Backlash of teeth	mm	0.3 ... 0.6		0.3 ... 0.6					
Pinion clearance	mm	2.0 ... 3.0		2.0 ... 3.0					



1 = Series winding
4 = Holding winding
13 = Pull-in winding



A12

Test specifications

Starting motor 0 001 ..



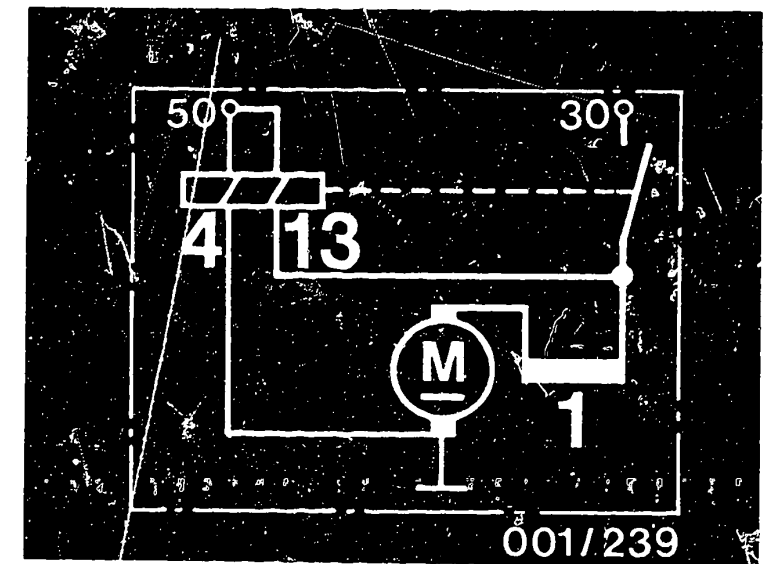
A13

Test specifications

Starting motor 0 001 ..



Part no.	0 001 204 ..	0 001 205 ..	0 001 206 ..	0 001 207 ..					
Previous type code	ED 24 V 0.9 kW	ED 6V 0.5 kW	EED 0.8/2	EF 6V 0.5 kW					
Idle	V	23.5	5.5	11.5	5.5				
	< A	30	75	50	70				
	> min ⁻¹	6800	4500	5800	5500				
Short circuit	V	21	20	2.5	2.0	9	8	2.5	2.0
	A	190...	180...	300...	230...	290...	250...	300...	230...
Torque	> Nm	22	20	6.5	5.0	12.5	11	6.5	5.0
	Minimum voltage for solenoid switch	V	17	3.5	8.0	3.5			
Commutator dia.	new mm	36	36	36	35.3				
	minimum mm	33.5	33.5	33.5	33.5				
Brush press.	N	8 .. 9	8 ... 9	8 ... 9	8 ... 9				
Carbon-brush minimum length	mm	17	17	13	13				
Setting "a" relay	mm	42.2 ± 0.1	32.2 ± 0.1	32.2 ± 0.1	32.2 ± 0.1				
Burn-off reserve	mm	0.9 ... 1.5	0.9 ... 1.5	0.9 ... 1.5	0.7 ... 1.5				
Armature longitudinal clearance	mm	0.1 ... 0.3	0.1 ... 0.3	0.1 ... 0.3	0.1 ... 0.3				
Armature braking torque	Nm	0.3 ... 0.6	0.25 ... 0.5	0.3 ... 0.6	0.25 ... 0.4				
Overrunning torque, overrunning clutch	Nm	0.06 ... 0.1	0.14 ... 0.22	0.06 ... 0.1	0.14 ... 0.22				
Backlash of teeth	mm	0.3 ... 0.6	0.3 ... 0.6	0.3 ... 0.6	0.3 ... 0.6				
Pinion clearance	mm	2.0 ... 3.0	2.0 ... 3.0	2.0 ... 3.0	2.0 ... 3.0				



1 = Series winding
4 = Holding winding
13 = Pull-in winding

A14

Test specifications
Starting motor 0 001 ..



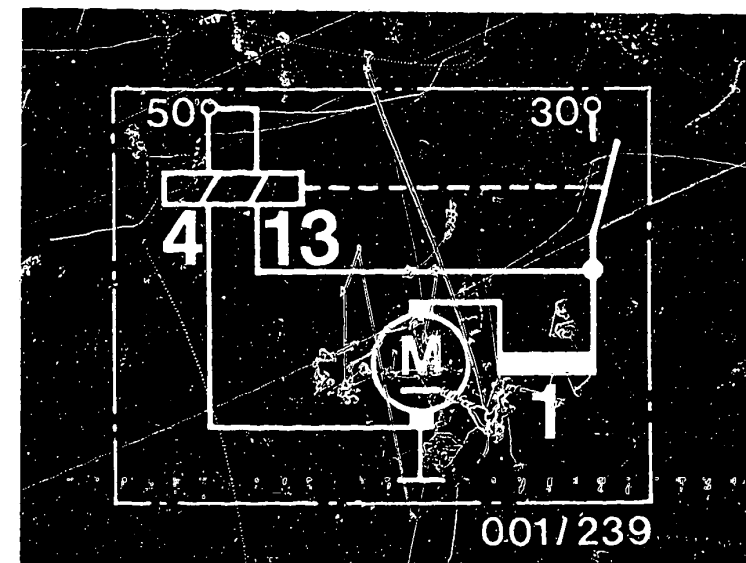
A15

Test specifications
Starting motor 0 001 ..



Part no.		0 001 208 ...	0 001 208 2..	0 001 208 4..	0 001 209 ...				
				... 208 5..					
Previous type code		EF 12V 0.85 kW	EF 12 V 0.85 kW	EF 12V 0.95 kW	EF 6V 0.45 kW				
Idle	V	11.5	11.5	11.5	5.5				
	< A	55	55	55	70				
	> min ⁻¹	6000	7000	7000	5500				
Short circuit	V	8.5	7.5	7.7	6.0	7.7	6.0	2.5	2.0
	A	320...	280...	400...	300...	450...	350...	260...	200...
		420	370	500	390	570	450	350	280
Torque	> Nm	12.5	11	13	11	13	11	5	4
Minimum voltage for solenoid switch	V	8.0	8.0	8.0	8.0	8.0	3.5		
Commutator dia.	new mm			36			36		
	minimum mm			33.5			33.5		
Brush press.	N		11.5 ... 13.5	(14.5...17) ⁴⁾			11.5 ... 13.5		
Carbon-brush minimum length	mm		13				13		
Setting "a" relay	mm	(16 ± 0.15) ¹⁾	28.5 ± 0.2	(19 ± 0.15) ²⁾			19 ± 0.15		
Burn-off reserve	mm		0.8 ... 1.2	(0.7 ... 1.5) ³⁾			0.7 ... 1.5		
Armature longitudinal clearance	mm		0.05 ... 0.3				0.1 ... 0.3		
Armature braking torque	Nm		0.25 ... 0.4				0.17 ... 0.33		
Overrunning torque, overrunning clutch	Nm		0.14 ... 0.22				0.14 ... 0.22		
Backlash of teeth	mm		0.3 ... 0.6				0.3 ... 0.6		
Pinion clearance	mm		2.0 ... 3.0				2.0 ... 3.0		

1) 0 001 208 051; 2) 0 001 208 058; 3) 0 001 208 051, .. 058; 4) 0 001 208 2.., 208 4..



1 = Series winding
4 = Holding winding
13 = Pull-in winding

A16

Test specifications

Starting motor 0 001 ..



A17

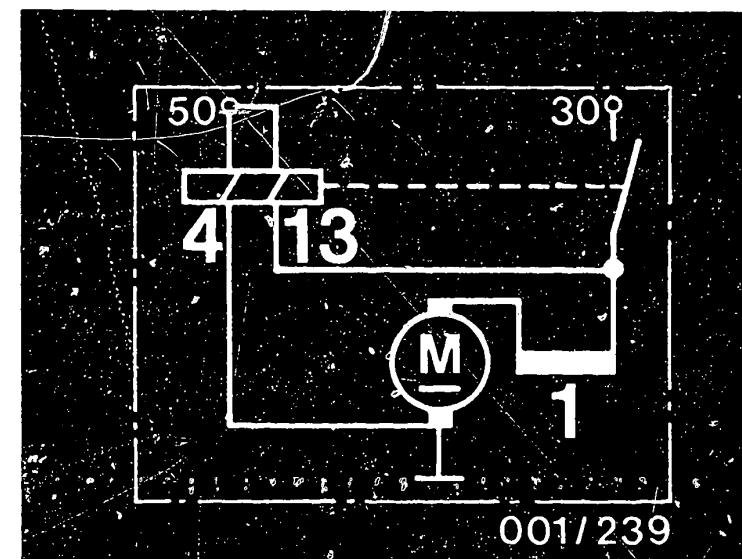
Test specifications

Starting motor 0 001 ..

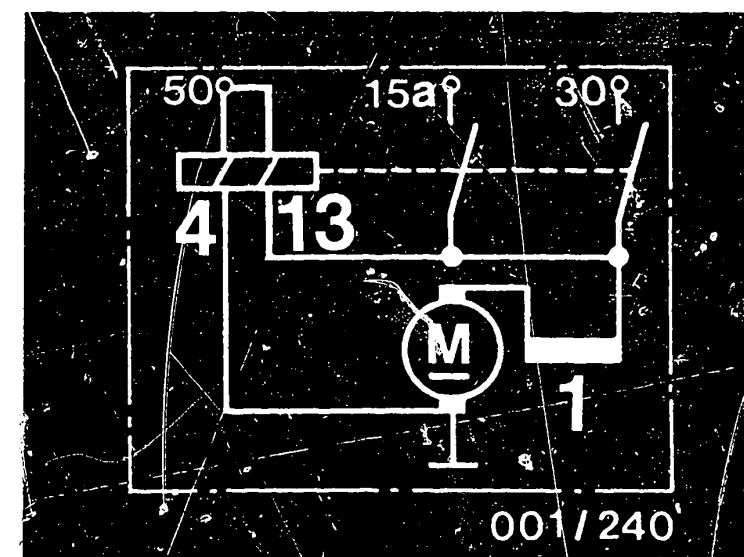


Part no.		0 001 211 ..	0 001 211 2..	0 001 211 9..			
Previous type code		EF 12V 0.8 kW	EF 12V 0.8 kW	EF 12V 0.8 kW			
Idle	V	11.5	11.5	11.5			
	< A	50	58	50			
	> min ⁻¹	6000	7000	6500			
Short circuit	V	9.0	8.0	8.5	7.5	8.5	7.5
	A	300...	260...	340...	290...	320...	270...
Torque	> Nm	390	350	430	380	410	360
		12	10	12	10	11.5	10
Minimum voltage for solenoid switch	V	8.0	8.0	8.0			
Commutator dia.	new mm	36					
	minimum mm	33.5					
Brush press.	N	11.5 ... 13.5					
Carbon-brush minimum length	mm	13					
Setting "a" relay	mm	19 ± 0.15		(16 ± 0.15) 1)			
Burn-off reserve	mm	0.7 ... 1.5					
Armature longitudinal clearance	mm	0.1 ... 0.3					
Armature braking torque	Nm	0.17 ... 0.33		(0.25...0.4) 1)			
Overrunning torque, overrunning clutch	Nm	0.14 ... 0.22					
Backlash of teeth	mm	0.3 ... 0.5					
Pinion clearance	mm	2.0 ... 3.0					

1) 0 001 211 2..., 0 001 211 9..



1 = Series winding
4 = Holding winding
13 = Pull-in winding



A18

Test specifications

Starting motor 0 001 ..



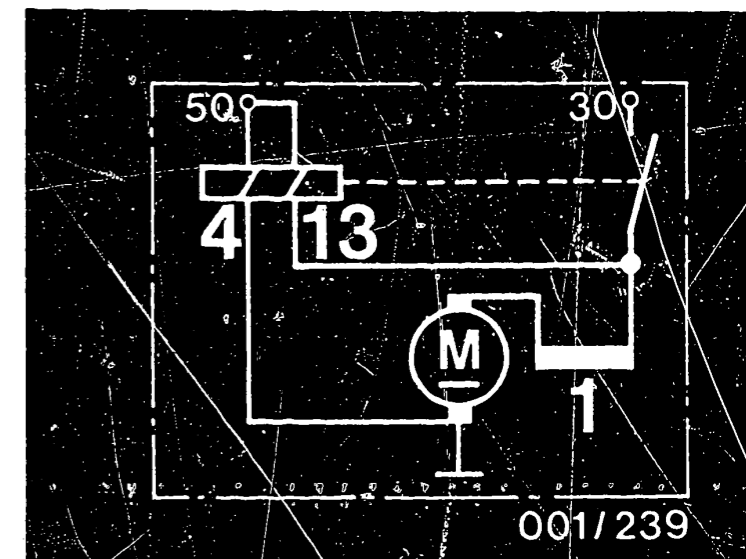
A19

Test specifications

Starting motor 0 001 ..



Part no.	0 001 212 ..	0 001 212 2..	0 001 213 ..	0 001 214 ..					
Previous type code	EB 12 V 0.8 kW	EB 12 V 0.8 kW	EB 6V 0.5 kW	EF 12V 0.9 kW					
Idle	V	11.5	11.5	5	11.5				
	< A	55	55	75	65				
	> min ⁻¹	6000	7000	5000	8000				
Short circuit	V	8.5	7.5	7	6	2.5	2.0	8	7
	A	320...	280...	300...	280...	290...	230...	400...	360...
Torque	> Nm	12.5	11	7.5	6.5	6.5	5	12	10
	Minimum voltage for solenoid switch	V	8.0	8.0	3.5	7.5			
Commutator dia.	new mm	36	35.3	35.3					
	minimum mm	33.5	33.5	33.5					
Brush press.	N	11.5 ... 13.5	11.5 ... 13.5	11.5 ... 13.5					
Carbon-brush minimum length	mm	13	13	13					
Setting "a" relay	mm	23 ± 0.15	23 ± 0.15	19 ± 0.15					
Burn-off reserve	mm	0.7 ... 1.5	0.7 ... 1.5	0.7 ... 1.5					
Armature longitudinal clearance	mm	0.1 ... 0.3	0.1 ... 0.3	0.1 ... 0.3					
Armature braking torque	Nm	0.35 ... 0.5	0.35 ... 0.5	0.35...0.5					
Overrunning torque, overrunning clutch	Nm	0.18 ... 0.25	0.18 ... 0.25	0.18 ... 0.25					
Backlash of teeth	mm	0.35 ... 0.6	0.35 ... 0.6	0.35 ... 0.6					
Pinion clearance	mm	2.0 ... 3.0	2.0 ... 3.0	2.0 ... 3.0					



1 = Series winding
4 = Holding winding
13 = Pull-in winding

A20

Test specifications

Starting motor 0 001 ..



A21

Test specifications

Starting motor 0 001 ..

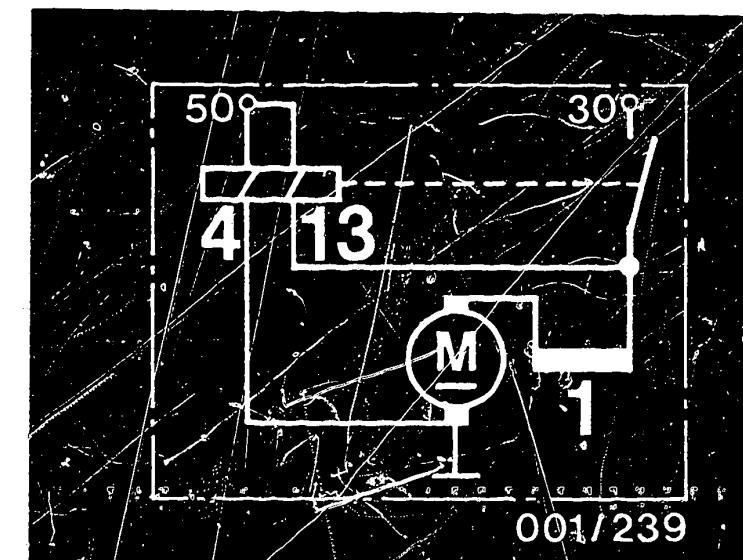


Part no.		0 001 215 ..	0 001 218 .. ¹⁾	0 001 304 ..	0 001 305 ..				
Previous type code		EB 12V 1.3 kW	EV 12V 2.2 kW	GD 6V 0.6 kW	GD 6V 0.5 kW				
Idle	V	11.5	10.5	5.5	11				
	< A	85	160	75	50				
	> min ⁻¹	8500	4200	4000	5500				
Short circuit	V	5.5	4.5	3.0	2.4	2.5	2	8.5	7.5
	A	620...	500...	720...	580...	290...	220...	360...	320...
Torque	> Nm	15	12.5	25	18	7	5.5	18	17
	Minimum voltage for solenoid switch	V	7.5	7.8	3.5	7.5			
Commutator dia.	new mm	36	30.0	35.3	35.3				
	minimum mm	33.5	28.9	33.5	33.5				
Brush press.	N	11.5 ... 13.5	-	9 ... 10.5	9 ... 10.5				
Carbon-brush minimum length	mm	13	7	17	17				
Setting "a" relay	mm	23 ± 0.15	-	32.2 ± 0.1	32.2 ± 0.1				
Burn-off reserve	mm	0.7 ... 1.5	0.8 ... 1.4	0.9 ... 1.5	0.9 ... 1.5				
Armature longitudinal clearance	mm	0.1 ... 0.3	0.05 ... 0.3	0.1 ... 0.3	0.1 ... 0.3				
Armature braking torque	Nm	0.35 ... 0.5	1.0 ... 1.5	0.3 ... 0.5	0.3 ... 0.5				
Overrunning torque, overrunning clutch	Nm	0.18 ... 0.25	0.14...0.22 ²⁾ 0.27...0.35 ³⁾	0.06 ... 0.1	0.14 ... 0.22				
Backlash of teeth	mm	0.35 ... 0.6	-	0.3 ... 0.6	0.3 ... 0.6				
Pinion clearance	mm	2.0 ... 3.0	-	2.0 ... 3.0	2.0 ... 3.0				

1) Test with 10 mΩ series resistor (connection term 30/2 with EFAL 152/153).

2) Overrunning clutch outside dia. 53.5

3) Overrunning clutch outside dia. 57.5 mm



1 = Series winding
4 = Holding winding
13 = Pull-in winding

A22

Test specifications

Starting motor 0 001 ..



A23

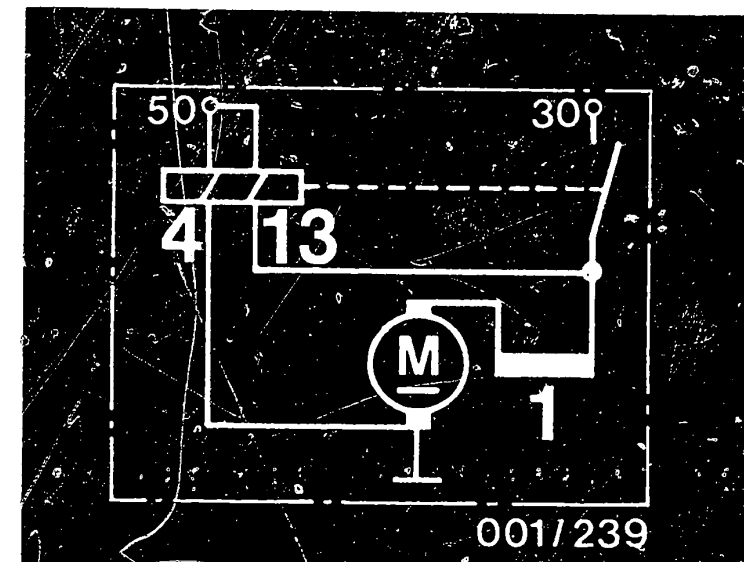
Test specifications

Starting motor 0 001 ..



Part no.	0 001 306 ..	0 001 307 ..	0 001 308 ..	0 001 308 1..					
Previous type code	GE 12V 1 kW	GE 12V 1.3 kW	GE 24V 1.4 kW	GE 24V 1.8 kW					
Idle	V	11.5	11.5	23.5	23.5				
	< A	50	70	35	50				
	> min ⁻¹	5500	6300	6000	6000				
Short circuit	V	8.5	7.5	7	6	20	19.5	20	19
	A	360...	320...	500...	430...	230...	210...	310...	300...
Torque	> Nm	450	400	610	530	320	300	400	380
		18	17	22	18.5	22	21	26	25
Minimum voltage for solenoid switch	V	7.5	7.5	15	15				
Commutator dia.	new mm	36	36	36	36				
	minimum mm	33.5	33.5	33.5	33.5				
Brush press	N	9 ... 10.5	9 ... 10.5 (13 ... 15) ¹	9 ... 10.5	9 ... 10.5				
Carbon-brush minimum length	mm	17	17	17	17				
Setting "a" relay	mm	32.2 ± 0.1	32.2 ± 0.1 (34 ± 0.1) ¹	42 ± 0.1	42 ± 0.1				
Burn-off reserve	mm	0.9 ... 1.5	0.9 ... 1.5 (0.9...1.6) ¹	0.9 ... 1.5	0.9 ... 1.5				
Armature longitudinal clearance	mm	0.1 ... 0.3	0.1 ... 0.3	0.1 ... 0.3	0.05...0.3				
Armature braking torque	Nm	0.3 ... 0.5	0.3 ... 0.5	0.3 ... 0.5	0.3 ... 0.5				
Overrunning torque, overrunning clutch	Nm	0.14 ... 0.22	0.26 ... 0.32	0.14 ... 0.22	0.28 ... 0.4				
Backlash of teeth	mm	0.3 ... 0.6	0.3 ... 0.6	0.3 ... 0.6	0.3 ... 0.6				
Pinion clearance	mm	2.0 ... 3.0	2.0 ... 3.0	2.0 ... 3.0	2.0 ... 3.0				

1) 0 001 307 019



1 = Series winding
4 = Holding winding
13 = Pull-in winding

B1

Test specifications

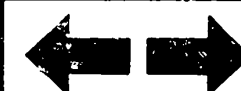
Starting motor 0 001 ..



B2

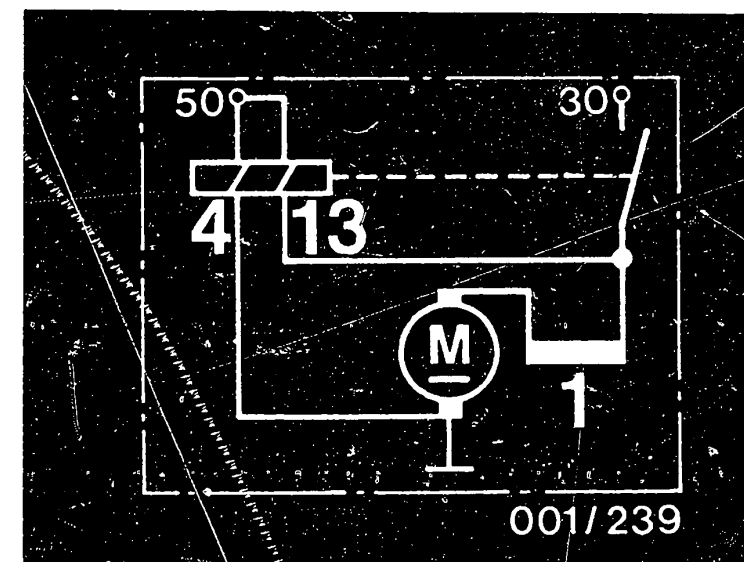
Test specifications

Starting motor 0 001 ..

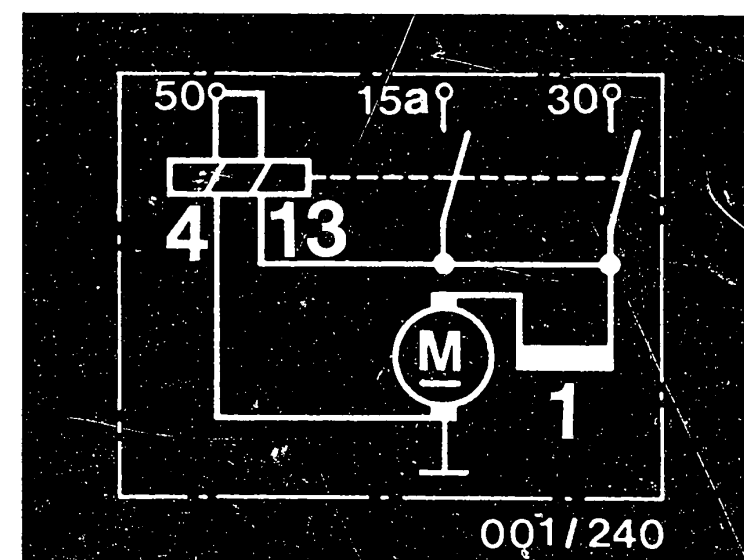


Part no.	0 001 310 ..	0 001 311 ..	0 001 311 033	0 001 311 042					
			0 001 311 043	047					
				050					
				056					
Previous type code	GF 6V 0.55 kW	GF 12 V 1 kW	GF 12V 1.1 kW	GF 12V 1.35 kW					
Idle	V	5.5	11.5	11.5					
	< A	65	50	70					
	> min ⁻¹	4500	5500	5800					
Short circuit	V	2.5	2	8.5	7.5	7	6	7.5	6.5
	A	290...	220...	350...	310...	400...	330...	480...	410...
		370	300	450	400	490	420	560	490
Torque	> Nm	7	5.5	18	16	14	12	10	
Minimum voltage for solenoid switch	V	3.5		7.5		7.5		8.0	
Commutator dia.	new mm	35.3				36			
	minimum mm	33.5				33.5			
Brush press	N	11.5 ... 13.5				11.5 ... 13.5			
Carbon-brush									
minimum length	mm	17				13			
Setting "a" relay	mm	19 ± 0.1				19 ± 0.1			
Burn-off reserve	mm	0.9 ... 1.5				0.7 ... 1.5			
Armature longitudinal clearance	mm	0.5 ... 0.3				0.05 ... 0.3			(0.1 ... 0.3) 1)
Armature braking torque	Nm	0.25 ... 0.4				0.25 ... 0.4			(0.3 ... 0.55) 1)
Overrunning torque, overrunning clutch	Nm	0.14 ... 0.22				0.14 ... 0.22			
Backlash of teeth	mm	0.3 ... 0.6				0.3 ... 0.6			
Pinion clearance	mm	2.0 ... 3.0				2.0 ... 3.0			

1) 0 001 311 042



1 = Series winding
4 = Holding winding
13 = Pull-in winding



B3

Test specifications

Starting motor 0 001 ..



B4

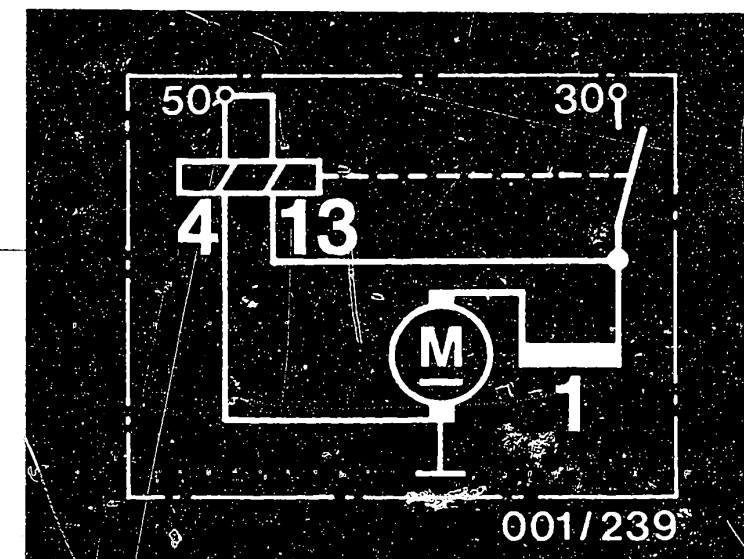
Test specifications

Starting motor 0 001 ..

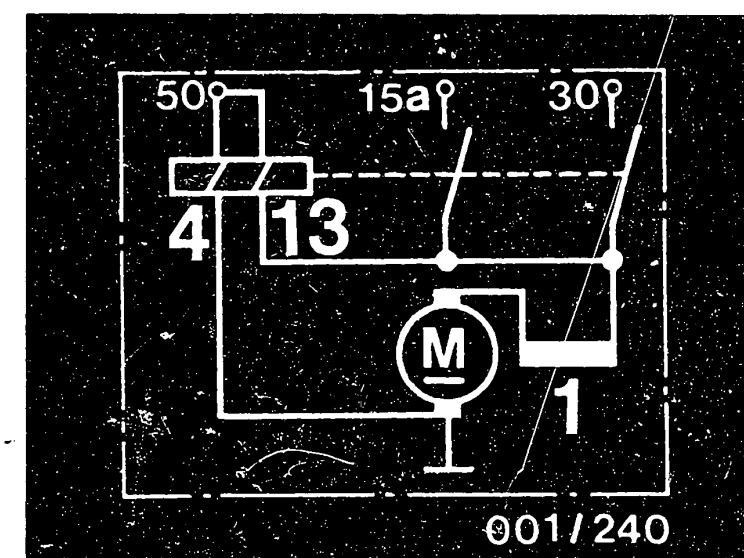


Part no.		0 001 311 1..	0 001 312 ..	0 001 312 1..	0 001 313 ..				
Previous type code		GF 12 V 1.1 kW	GE 12V 1.5 kW	GB 12 V 1.5 kW	GF 12V 1.5 kW				
Idle	V	11.5	11	11.5	11.5				
	< A	70	115	85	80				
	> min ⁻¹	7500	8500	8500	8000				
Short circuit	V	7.4	6.5	5	4	6	5	6	5
	A	480...	410...	660...	520...	650...	530...	520...	430...
Torque	> Nm	16	15	15	12	19	16	17	14.8
	V	8.0		7.5		8.0		7.5	
Minimum voltage for solenoid switch	V	8.0		7.5		8.0		7.5	
Commutator dia.	new mm	36		36		36		36	
	minimum mm	33.5		33.5		33.5		33.5	
Brush press.	N	18 ... 21	18 ... 21	(15 ... 17) ¹⁾	18 ... 21				
Carbon-brush minimum length	mm	13		13	13				
Setting "a" relay	mm	28.5 ± 0.2	23 ± 0.15	(31 ± 0.2) ¹⁾	19 ± 0.1				
Burn-off reserve	mm	0.8 ... 1.2	0.7 ... 1.5	(0.8...1.2) ¹⁾	0.7 ... 1.5				
Armature longitudinal clearance	mm	0.1 ... 0.3		0.1 ... 0.3	0.05 ... 0.3				
Armature braking torque	Nm	0.3 ... 0.55		0.3 ... 0.55	0.3 ... 0.55				
Overrunning torque, overrunning clutch	Nm	0.14 ... 0.22	0.14...0.22	(0.18...0.28) ¹⁾	0.14 ... 0.22				
Backlash of teeth	mm	0.3 ... 0.6		0.3 ... 0.6	0.3 ... 0.6				
Pinion clearance	mm	2.0 ... 3.0		2.0 ... 3.0	2.0 ... 3.0				

1) 0 001 312 104, .. 105



1 = Series winding
4 = Holding winding
13 = Pull-in winding



B5

Test specifications
Starting motor 0 001 ..



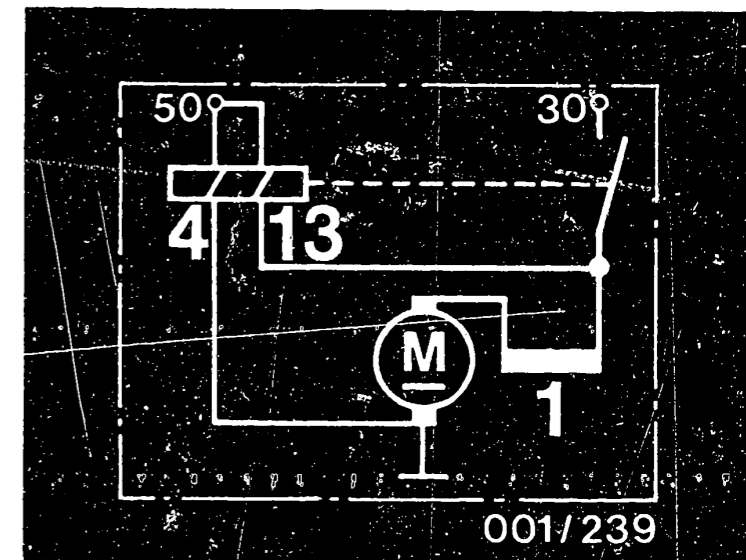
B6

Test specifications
Starting motor 0 001 ..

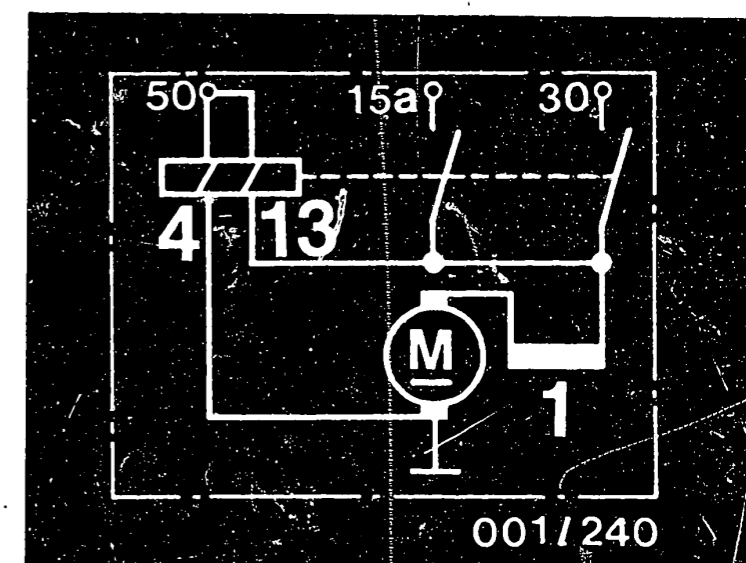


Part no.		0 001 314 ..	0 001 315 ..	0 001 316 .. ¹⁾	0 001 317 .. ¹⁾				
Previous type code		GF 12V 1.5 kW	GF 12V 1.9 kW	GF 24V 1.6 kW	GF 12V 1.7 kW				
Idle	V	11.5	11	23.5	11.5				
	< A	80	85	35	80				
	> min ⁻¹	7500	9000	7000	7500				
Short circuit	V	6	5	5.5	5	18	19	5.5	5.0
	A	690...	560...	680...	610...	270...	290...	700...	650...
Torque	> Nm	22	19	17	15	24	25	22	20
Minimum voltage for solenoid switch	V	7.5	7.5	17.5	7.5				
Commutator dia.	new mm	36	36	36	35.3				
	minimum mm	33.5	33.5	33.5	33.5				
Brush press.	N	18 ... 21	11.5 ... 13.5	18 ... 21	16 ... 21				
Carbon-brush minimum length	mm	13	13	13	10				
Setting "a" relay	mm	19 ± 0.1	19 ± 0.1	-	-				
Burn-off reserve	mm	0.7 ... 1.5	0.7 ... 1.5	0.7 ... 1.5	-				
Armature longitudinal clearance	mm	0.05 ... 0.3	0.05 ... 0.3	0.05 ... 0.3	0.05 ... 0.3				
Armature braking torque	Nm	0.3 ... 0.55	0.3 ... 0.55	0.3 ... 0.55	0.3 ... 0.6				
Overrunning torque, overrunning clutch	Nm	0.14...0.22	0.14...0.22	0.14 ... 0.22	0.18 ... 0.26				
Backlash of teeth	mm	0.3 ... 0.6	0.3 ... 0.6	0.3 ... 0.6	0.3 ... 0.6				
Pinion clearance	mm	2.0 ... 3.0	2.0 ... 3.0	2.0 ... 3.0	2.0 ... 3.0				

- 1) Test with 10 mΩ series resistor (connection term. 30/2 with test bench EFAL 152/153) or separate 10 mΩ series resistor
2) Overrunning torque increased as of April 1979



1 = Series winding
4 = Holding winding
13 = Pull-in winding



B7

Test specifications

Starting motor 0 001 ..



B8

Test specifications

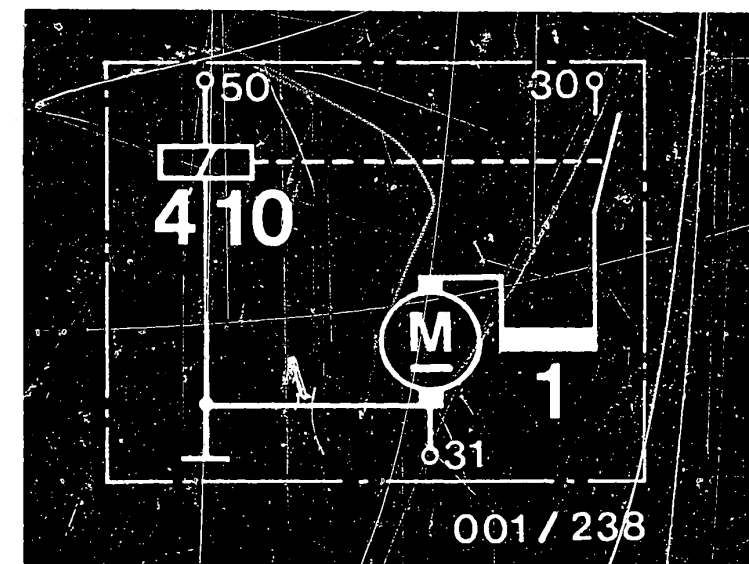
Starting motor 0 001 ..



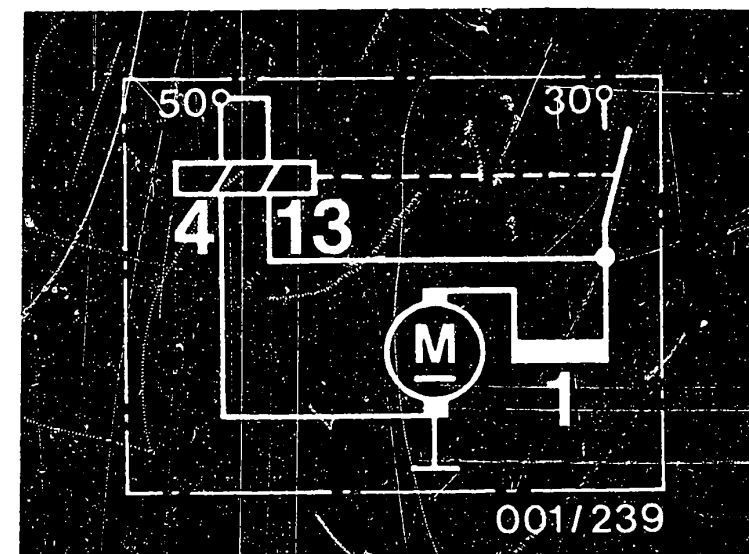
Part no.		0 001 354 ..	0 001 355 ..	0 001 356 ..	0 001 358 ..				
Previous type code		JD 12V 1.8 kW	JD 24V 2 kW	JB 12V 1.8 kW	JD 12V 2.3 kW				
Idle	V	11.5	23.5	11.5	11.5				
	< A	90	45	90	90				
	> min ⁻¹	5000	6000	5000	6000				
Short circuit	V	6.5	5.5	18	17	6.5	5.5	5.5	4.5
	A	580...	480...	420...	410...	680...	580...	610...	480...
Torque		800	700	520	510	830	730	760	630
	> Nm	37	33	41	39	34	29	44	37
Minimum voltage for solenoid switch	V	8		17		8		8	
Commutator dia.									
	new mm	42		42		42		42	
	minimum mm	39.5		39.5		39.5		39.5	
Brush press.	N	10.5 ... 13.5	10.5 ... 13.5	10 ... 13	10 ... 13				
Carbon-brush minimum length	mm	15.5	15.5	15.5	15.5				
Setting "a" relay	mm	34 ± 0.2 (49 ± 0.2) ¹⁾	34 ± 0.2 (35 ± 0.2) ³⁾	-	52.7 ± 0.2				
Burn-off reserve	mm	1.0 ... 2.0	1.0 ... 2.0	1.0 ... 1.6	1.0 ... 2.0				
Armature longitudinal clearance	mm	0.1 ... 0.3	0.1 ... 0.3	0.1 ... 0.3	0.1 ... 0.3				
Armature braking torque	Nm	0.45...0.75	0.45...0.75	0.45...0.6	0.6 ... 0.8				
Overrunning torque, overrunning clutch	Nm	0.07...0.08	0.07...0.08	0.2 ... 0.3	0.26...0.32				
		(0.26...0.32) ²⁾	0.26...0.32 ²⁾						
Backlash of teeth	mm	0.3 ... 0.6	0.3 ... 0.6	0.35...0.6	0.35...0.6				
Pinion clearance	mm	2.0 ... 3.0	2.0 ... 3.0	2.5 ... 4.0	2.5 ... 4.0				

1) 0 001 354 031
3) 0 001 355 003

2) Overrunning torque increased as of April 1979



1 = Series winding
4 = Holding winding
10 = Solenoid switch
13 = Pull-in winding



B9

Test specifications

Starting motor 0 001 ..



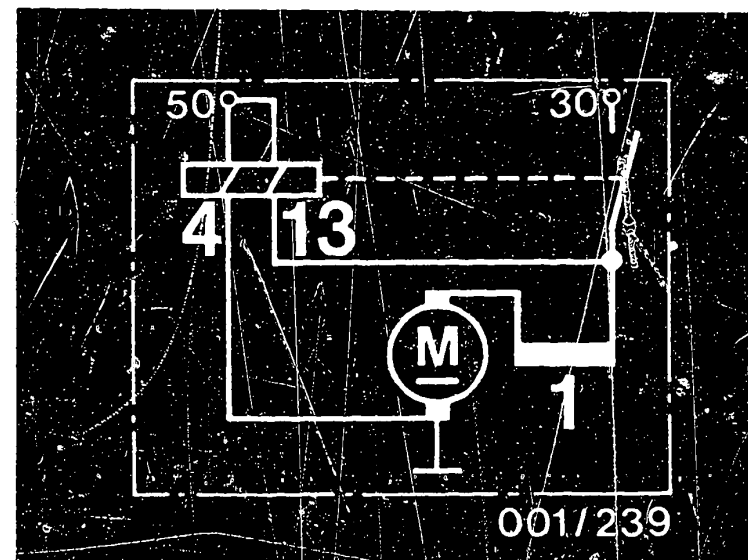
B10

Test specifications

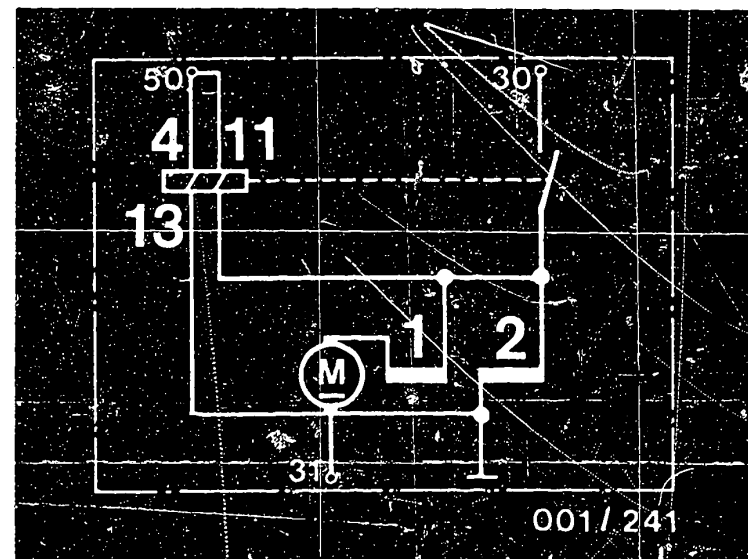
Starting motor 0 001 ..



Part no.		0 001 358 2..	0 001 359 ..	from 0 001 359 050	0 001 360 ..				
Previous type code		JD 12V 2.5 kW	JD 12V 3 kW	JD 12V 3 kW	JD 24V 4 kW				
Idle	V	11	11.5	11	23.5				
	< A	120	90	130	50				
	> min ⁻¹	8000	4800	7500	5500				
Short circuit	V	4.5	4.0	4.0	3.5	4.0	3.5	14	13
	A	870...	770...	760...	650...	850...	730...	950...	850...
Torque	> Nm	1070	970	900	800	1050	930	1100	1000
		34	29	45	38	45	38	60	45
Minimum voltage for solenoid switch	V	8	8	8	8	18			
Commutator dia.	new mm	42		45		42			
	minimum mm	39.5		42.5		39.5			
Brush press.	N	26 ... 28		36 ... 38		26 ... 28			
Carbon-brush minimum length	mm	15.5		15.5		15.5			
Setting "a" relay	mm	-		-		-			
Burn-off reserve	mm	1.2 ... 1.5		1.0 ... 2.0		1.0 ... 2.0			
Armature longitudinal clearance	mm	0.1 ... 0.3		0.1 ... 0.3		0.1 ... 0.3			
Armature braking torque	Nm	0.8 ... 1.2		0.45 ... 0.75		0.4 ... 0.55			
Overrunning torque, overrunning clutch	Nm	0.45 ... 0.7		0.4 ... 0.55		0.4 ... 0.55			
Backlash of teeth	mm	0.4 ... 0.6		0.35 ... 0.6		0.35 ... 0.6			
Pinion clearance	mm	2.5 ... 4.0		2.5 ... 4.0		2.5 ... 4.0			



- 1 = Series winding
- 2 = Shunt winding
- 4 = Holding winding
- 11 = Control relay
- 13 = Pull-in winding



B11

Test specifications
Starting motor 0 001 ..



B12

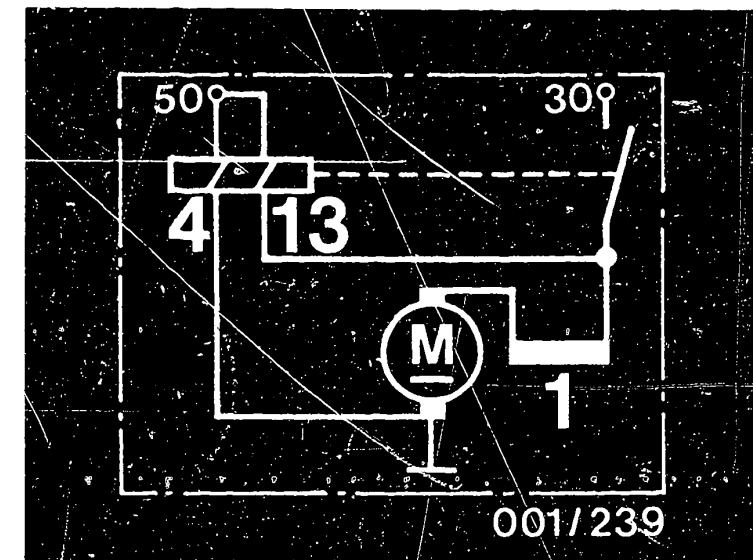
Test specifications
Starting motor 0 001 ..



Part no.	as of	0 001 362 ..	0 001 362 3..	0 001 363 ..
	0 001 360 026		362 6..	
Previous type code	JD 24V 4 kW	JF 12V 2.0 kW 2.4 kW	JF 12V 2.7 kW 2.3 kW	JF 24V 3.0 kW 3.2 kW
Idle	V	23	11.5	11.5
	< A	85	95	125
	> min ⁻¹	7500	6500	7000
Short circuit	V	14	13	4.5
	A	900...	800...	700...
		1100	1000	880
Torque	> Nm	68	60	34
				26
Minimum voltage for solenoid switch	V	18	7.5	7.5
				18
Commutator dia.	new mm	.42	42(45) ¹⁾	45
	minimum mm	39.5	39.5(42.5) ¹⁾	42.5
Brush press.	N	26 ... 28	11.5 ... 13	23 ... 25
			(23 ... 25) ²⁾	(23 ... 25) ²⁾
Carbon-brush minimum length	mm	15.5	15.5	8.5
			8.5 ²⁾	(8.5) ²⁾
Setting "a" relay	mm	-	-	-
Burn-off reserve	mm	1.0 ... 2.0	1.0 ... 2.0	1.0 ... 2.0
Armature longitudinal clearance	mm	0.1 ... 0.3	0.1 ... 0.3	0.1 ... 0.4
Armature braking torque	Nm	0.4 ... 0.55	0.45...0.75	0.45...0.75
Overrunning torque, overrunning clutch	Nm	0.4 ... 0.55	0.4 ... 0.55	0.4 ... 0.65
Backlash of teeth	mm	0.35 ... 0.6	0.4 ... 0.7	0.4 ... 0.7
Pinion clearance	mm	2.5 ... 4.0	2.5 ... 4.0	2.5 ... 4.0

1) As of FD (date of manufacture) 921/922

2) With tubular brush holder



1 = Series winding
4 = Holding winding
13 = Pull-in winding

B13

Test specifications

Starting motor 0 001 ..



B14

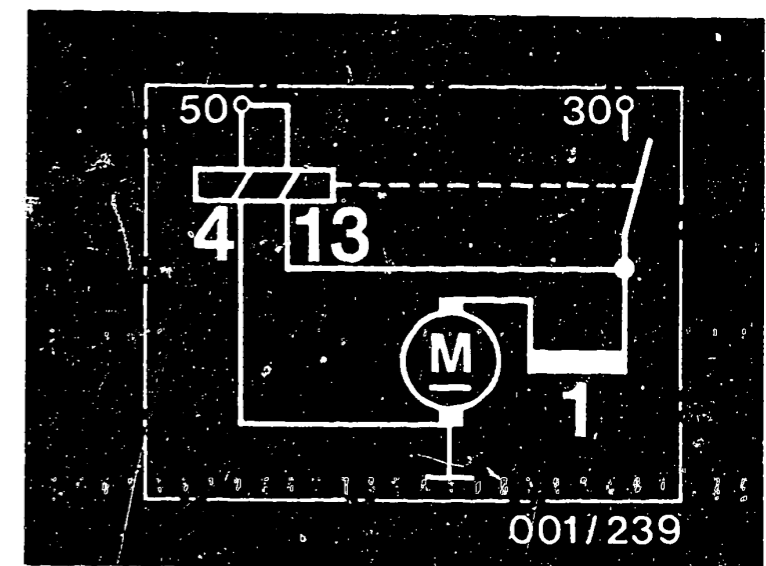
Test specifications

Starting motor 0 001 ..

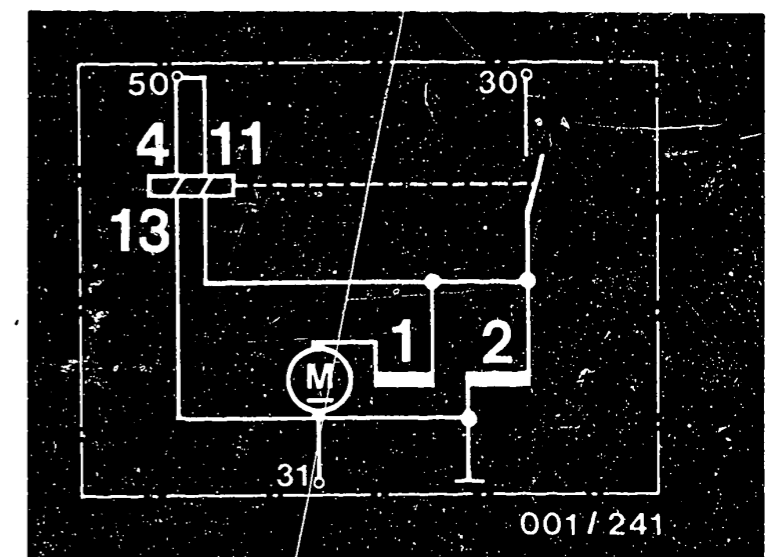


Part no.		0 001 364 ..	0 001 364 1..	0 001 365 .. ¹⁾	0 001 366 ..			
			364 2..					
Previous type code		JD 24V 4.6 kW	JD 24V 4.8 kW	JD 12V 3.7 kW	JF 12V 1.9 kW			
Idle	V	23	23	11.4	11.5			
	< A	95	85	120	95			
	> min ⁻¹	6500	6500	5500	6500			
Short circuit	V	8.5	7.5	12	11	5.6	4.5	5.5
	A	1070...	940...	970...	870...	1450...	1150...	720...880
		1250	1100	1170	1070	1650	1340	
Torque	> Nm	58	52	70	60	52	48	39
Minimum voltage for solenoid switch	V	15	18	8	8			
Commutator dia.	new mm	42	42	45	42.1			
	minimum mm	39.5	39.5	42.5	39.5			
Brush press.	N	26 ... 28	26 ... 28	26 ... 38	-			
Carbon-brush minimum length	mm	15.5	15.5	15.5	15.5			
Setting "a" relay	mm	34 ± 0.1	-	-	-			
Burn-off reserve	mm	1.0 ... 2.0	0.7 ... 1.3	0.7 ... 1.3	0.7 ... 1.3			
Armature longitudinal clearance	mm	0.1 ... 0.3	0.1 ... 0.3	0.1 ... 0.4	0.1 ... 0.3			
Armature braking torque	Nm	-	0.5 ... 1.2	0.5 ... 1.2	0.45 ... 0.75			
Overrunning torque, overrunning clutch	Nm	0.45 ... 0.55	0.35 ... 0.65	0.35 ... 0.65	0.4 ... 0.65			
Backlash of teeth	mm	0.3 ... 0.6	0.4 ... 0.7	0.4 ... 0.7	0.4 ... 0.7			
Pinion clearance	mm	2.5 ... 4.0	2.5 ... 4.0	2.5 ... 4.0	2.5 ... 4.0			

1) Testing with batteries in parallel connection



- 1 = Series winding
- 2 = Shunt winding
- 4 = Holding winding
- 11 = Control relay
- 13 = Pull-in winding



B 15

Test specifications
Starting motor 0 001 ..



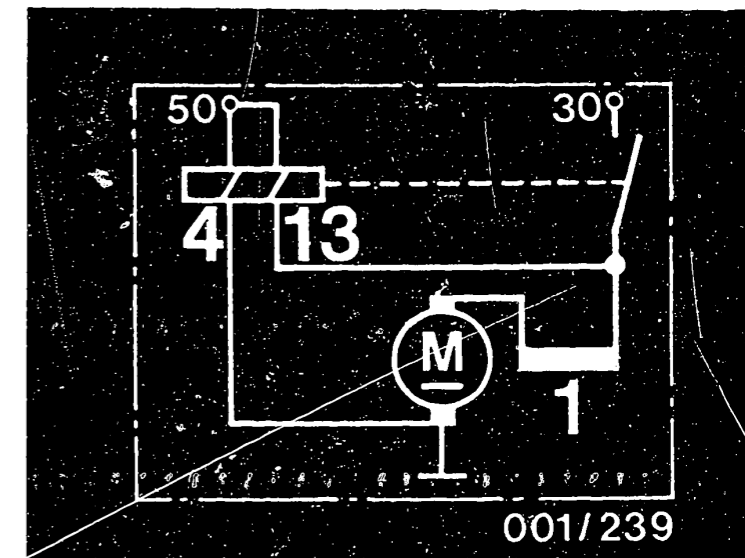
B 16

Test specifications
Starting motor 0 001 ..



Part no.		0 001 367 .. 1)	0 001 368 ..
Previous type code		JF 12V 3 kW	JF 24V 4 kW
Idle	V	11.5	23
	< A	130	85
	> min ⁻¹	7000	7000
Short circuit	V	7.2	13.5
	A	1150...1300	900...1050
Torque	> Nm	57	65
Minimum voltage for solenoid switch	V	8	18
Commutator dia.	new mm	45	45
	minimum mm	42.5	42.5
Brush press.	N	-	-
Carbon-brush minimum length	mm	15.5	15.5
Setting "a" relay	mm	-	-
Burn-off reserve	mm	0.7 ... 1.3	0.7 ... 1.3
Armature longitudinal clearance	mm	0.1 ... 0.3	0.1 ... 0.3
Armature braking torque	Nm	0.5 ... 1.2	0.5 ... 1.2
Overrunning torque	Nm	0.35 ... 0.65	0.35 ... 0.65
Backlash of teeth	mm	0.4 ... 0.7	0.4 ... 0.7
Pinion clearance	mm	2.5 ... 4.0	2.5 ... 4.0

1) Test with parallel-connected batteries



1 = Series winding
4 = Holding winding
13 = Pull-in winding

B17

Test specifications
Starting motor 0 001 ..

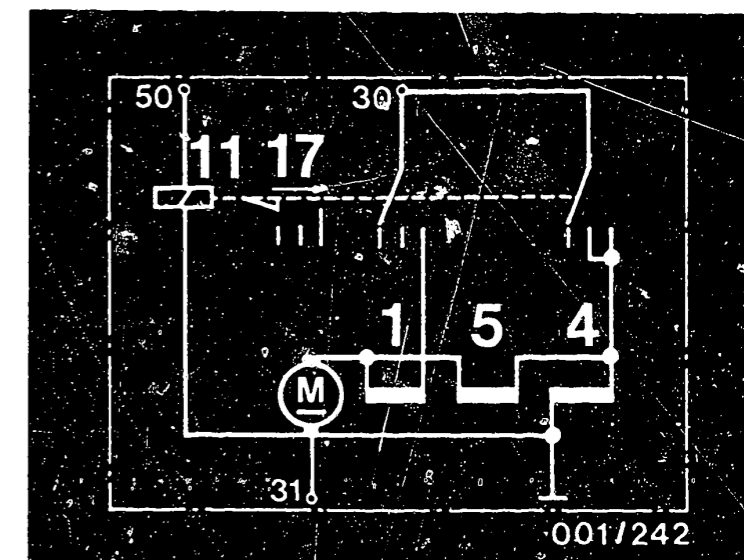


B18

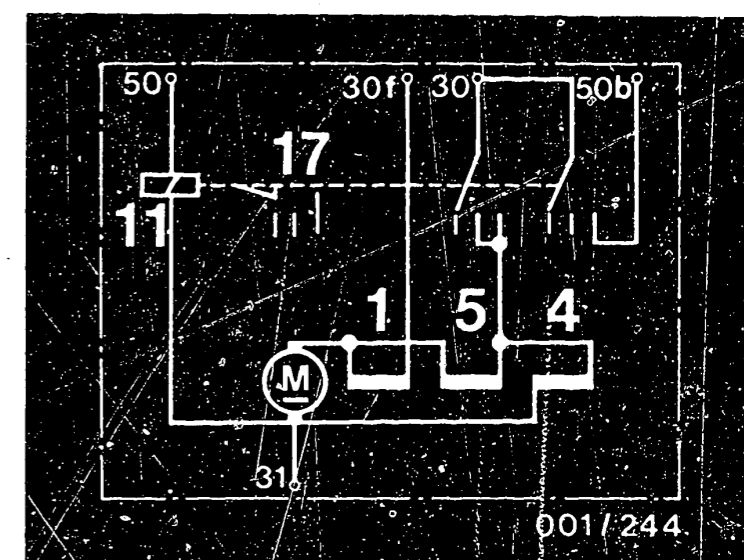
Test specifications
Starting motor 0 001 ..



Part no.		0 001 400 ..	0 001 401 ..	0 001 402 ..			
Previous type code		BNG 2.5/12	KG 12V 4 kW	KG 24V 4 kW			
Idle	V	11	10.5	23			
	< A	120	160	95			
	> min ⁻¹	2000	3000	3100			
Short circuit	V	5	4	3.5	3	13	12
	A	740...	560...	830...	700...	900...	840...
Torque	> Nm	55	49	47	42	65	60
	Minimum voltage for solenoid switch	V	8	8	15		
Commutator dia.	new	mm	48	48	48		
	minimum	mm	45	45	45		
Brush press	N	12 ... 15	12 ... 15	12 ... 15			
Carbon-brush minimum length	mm	11	11	17.5			
Tripping "b" relay	mm	12.0 ... 14.8	12.0 ... 14.8	12.0 ... 14.8			
Armature travel longitudinal clearance	mm	24 ... 26	24 ... 26	24 ... 26			
Longitudinal clearance for pinion	mm	0.5 ... 2.5	0.5 ... 3.0	0.5 ... 3.0			
Armature-return spring	mm	38 ... 42	38 ... 42	38 ... 42			
Multi-plate clutch							
Overrunning torque	Nm	0.75 ... 1.05	0.75 ... 1.05	0.75 ... 1.05			
Initial stage	Nm	0.4 ... 0.6	0.4 ... 0.6	0.4 ... 0.6			
Slip torque	Nm	120 ... 150	130 ... 150	130 ... 150			
Backlash of teeth	mm	0.6 ... 0.8	0.6 ... 0.8	0.6 ... 0.8			
Pinion clearance	mm	3.0 ... 4.0	3.0 ... 4.0	3.0 ... 4.0			



- 1 = Series winding
- 4 = Holding winding
- 5 = Auxiliary winding
- 11 = Control relay
- 17 = Tripping lever



B 19

Test specifications
Starting motor 0 001 ..

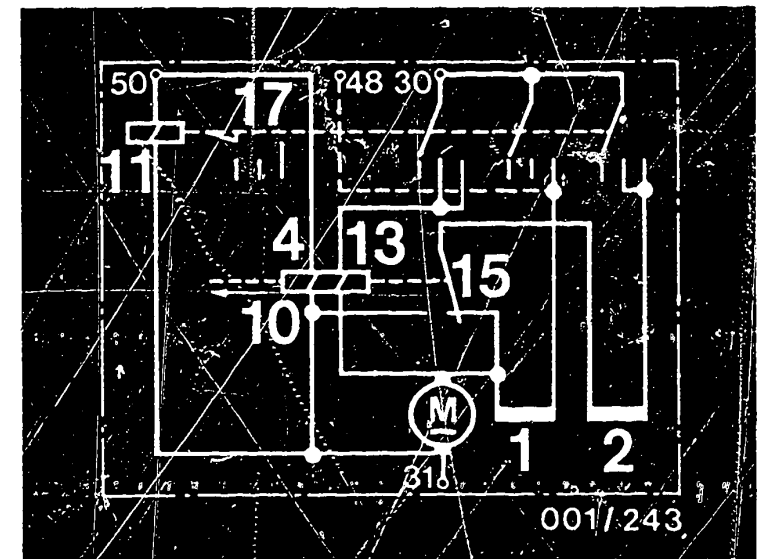


B 20

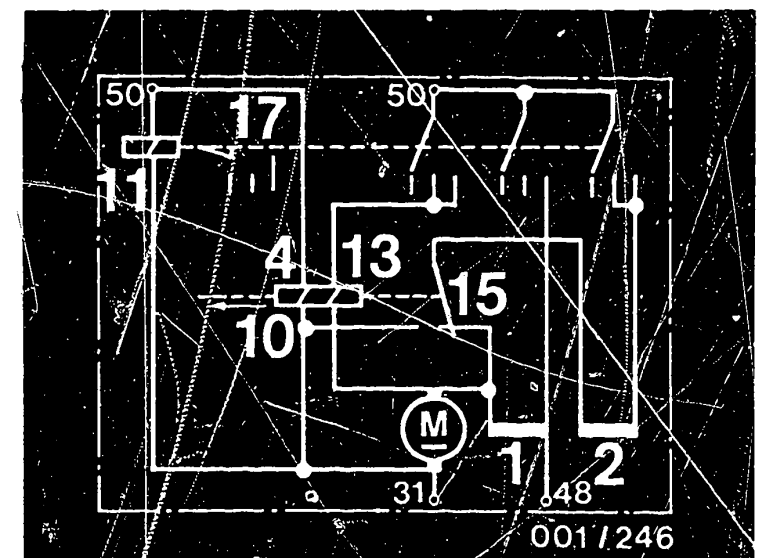
Test specifications
Starting motor 0 001 ..



Part no.		0 001 410 ..	0 001 410 057 .. 068	0 001 411 ..	0 001 412 ..				
Previous type code		KB 24V 5.5 kW	KG 24V 5.5 kW	KB 24V 6.5 kW	KB 24V 6.5 kW				
Idle	V	23	23.5	23	23				
	< A	115	105	95	85				
	> min ⁻¹	3700	3500	3900	3000				
Short circuit	V	8.5	7.5	9	8	8	7	9.5	8.5
	A	1220...	1080...	1120...	1000...	1260...	1120..	1200...	1050..
Torque	> Nm	1400	1270	1290	1160	1430	1270	1400	1250
		76	67	87	77	88	76	94	84
Minimum voltage for solenoid switch	V		15		15		15		
Commutator dia.	new mm		50		50		50		
	minimum mm		47		47		47		
Brush press.	N		24 ... 29		24 ... 29		24 ... 29		
Carbon-brush minimum length	mm		17.5		17.5		17.5		
Armature longitudinal clearance	mm		0.2 ... 0.6		0.2 ... 0.6		0.2 ... 0.6		
Longitudinal clearance for drive spindle	mm		0.3		0.3		0.3		
Return spring for pinion and solenoid switch	N		35 ... 45		35 ... 45		35 ... 45		
Initial and final pressure	N		60 ... 70		60 ... 70		60 ... 70		
Multi-plate clutch									
Overrunning torque	Nm		0.2 ... 0.4		0.2 ... 0.4		0.3 .. 0.5		
Slip torque	Nm		160 ... 200		160 ... 200		160 ... 200		
Backlash of teeth	mm		0.7 ... 0.9		0.6 ... 1.0		0.6 ... 0.9		
Pinion clearance	mm		3.0 ... 4.0		3.0 ... 4.0		3.0 ... 4.0		



- 1 = Series winding
- 2 = Shunt winding
- 4 = Holding winding
- 10 = Solenoid switch
- 11 = Control relay
- 13 = Pull-in winding
- 15 = Change-over contact (break-before-make)
- 17 = Tripping lever



B21

Test specifications

Starting motor 0 001 ..



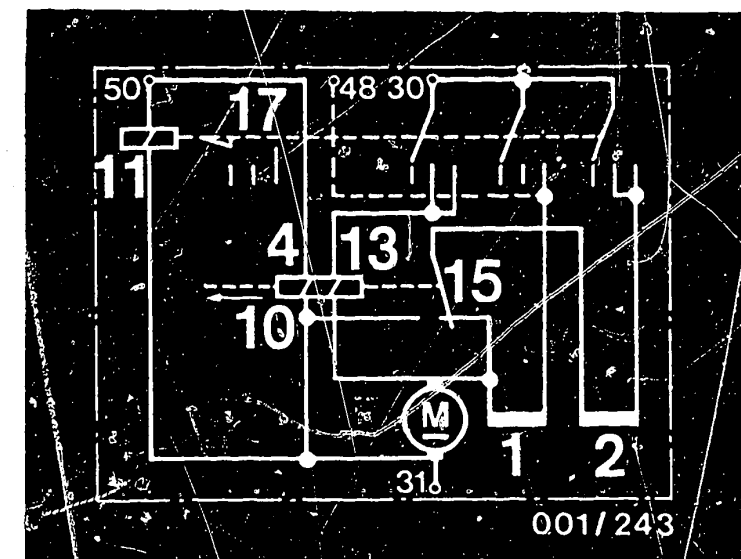
B22

Test specifications

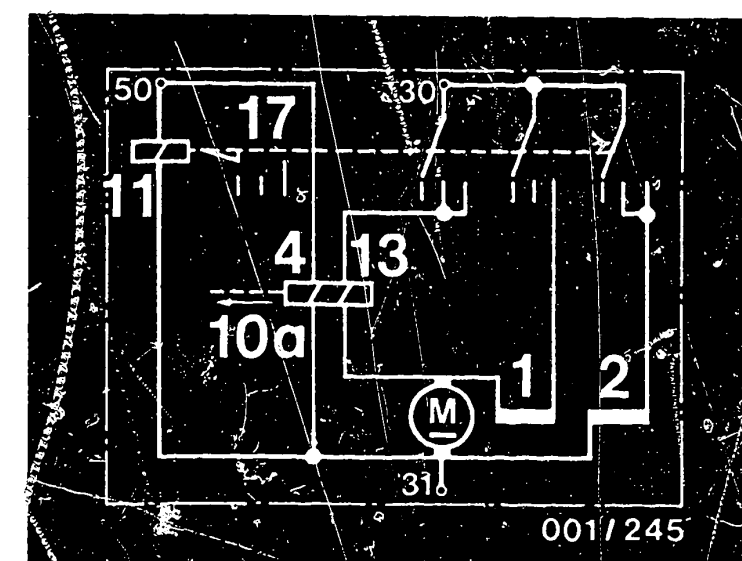
Starting motor 0 001 ..



Part no.	0 001 413 ..	0 001 414 ..	0 001 415 ..	0 001 416 ..
Previous type code	KB 12V 3.5 kW	KG 24V 4.5 kW	KB 24V 5 kW	KB 24V 5.4 kW
Idle	V	11	23	23
	< A	160	95	95
	> min ⁻¹	3600	4000	4000
Short circuit	V	5.3	10.5	10.3
	A	1500 ... 1680	1050 ... 1200	1100 ... 1250
				1680... 1550...
Torque	> Nm	40	62	65
				98
Minimum voltage for solenoid switch	V	8	15	15
Commutator dia.	new mm		50	
	minimum mm		48	
Brush press.	N		24 ... 29	
Carbon-brush minimum length	mm		17.5	
Armature longitudinal clearance	mm		0.2 ... 0.6	
Longitudinal clearance for drive spindle	mm		0.3	
Return spring for pinion and solenoid switch	N		35 ... 45	
Initial and final pressure	N		60 ... 70	
Multi-plate clutch				
Overtorque torque	Nm		0.2 ... 0.4	
Slip torque	Nm		160 ... 200	
Backlash of teeth	mm		0.6 ... 0.9	
Pinion clearance	mm		3.0 ... 4.0	



- 1 = Series winding
- 2 = Shunt winding
- 4 = Holding winding
- 10 = Solenoid switch
- 10a = Starting motor solenoid
- 11 = Control relay
- 13 = Pull-in winding
- 15 = Change-over contact (break-before make)
- 17 = Tripping lever



B23

Test specifications

Starting motor 0 001 ..



B24

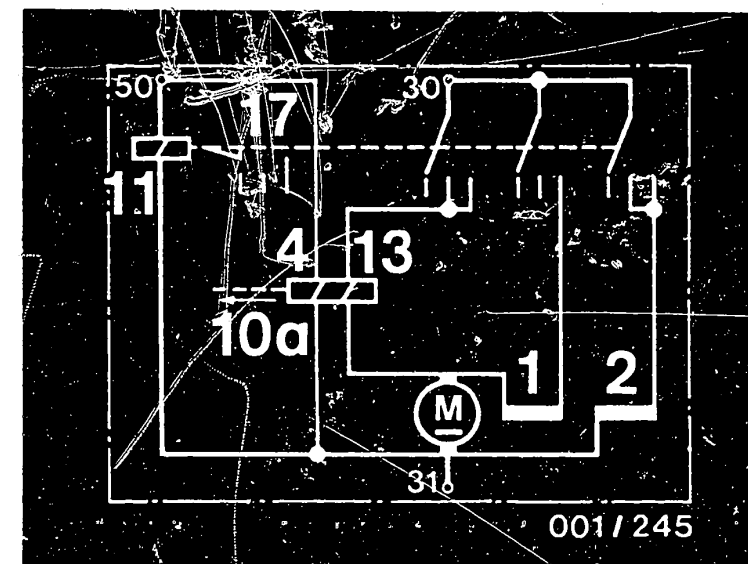
Test specifications

Starting motor 0 001 ..

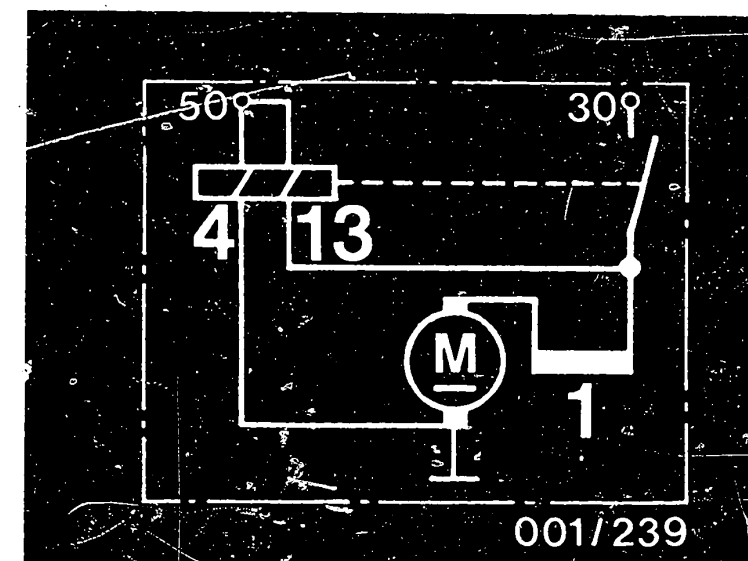


Part no.	0 001 417 ..	0 001 418 ..	0 001 420 ..	0 001 421 ..				
Previous type code	KB 24V 6.6 kW	KB 12V 3.6 kW	KE 24V 7.5 kW	KE 12V 5.5 kW				
Idle	V	23	11	24				
	< A	120	220	140				
	> min ⁻¹	4000	4200	5500				
Short circuit	V	12	11	5	4.5	9	4,0	4,5
	A	1630 ...	1480 ...	1800 ...	1500 ...	<1400	<1900	<2050
		1750	1600	1950	1650			
Torque	> Nm	110	100	45	35	110	75	90
Minimum voltage for solenoid switch	V	15	8	16	8			
Commutator dia.	new mm		50	50				
	minimum mm		48	48				
Brush press.	N		24 ... 29	47 ... 53				
Carbon-brush minimum length	mm		17.5	17.5				
Armature longitudinal clearance	mm		0.2 ... 0.6	0.1 ... 0.4 ¹⁾	0.1 ... 0.3 ²⁾			
Longitudinal clearance for drive spindle	mm		0.3	-				
Return spring for pinion and solenoid switch	N		35 ... 45	-				
Initial and final pressure	N		60 ... 70	-				
Multi-plate clutch								
Overrunning torque	Nm		0.2 ... 0.4	-				
Slip torque	Nm		160 ... 200					
Backlash of teeth	mm		0.6 ... 0.9	0.6 ... 0.9				
Pinion clearance	mm		3.0 ... 4.0	3.0 ... 4.0				
Setting "a" relay	mm			+ 0.2				
				62.5 - 0.5				

- 1) Without screw plug
2) With screw plug



- 1 = Series winding
2 = Shunt winding
4 = Holding winding
10a = Starting-motor solenoid
11 = Control relay
13 = Pull-in winding
17 = Tripping lever



C1

Test specifications

Starting motor 0 001 ..



C2

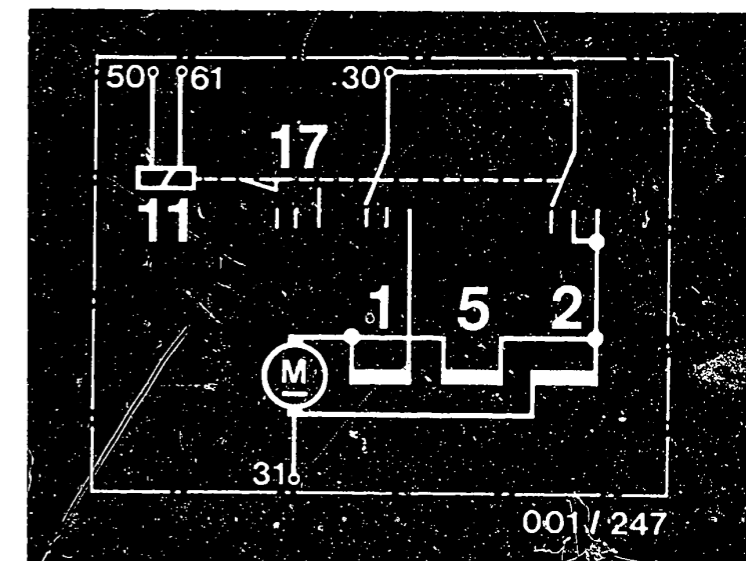
Test specifications

Starting motor 0 001 ..

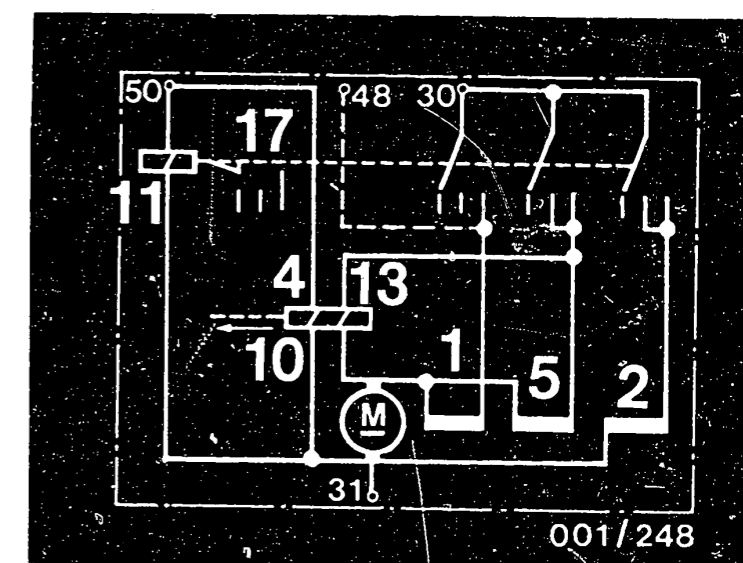


Part no.	0 001 500 ..	0 001 501 ..	0 001 510 ..
Previous type code	QD 12V 3 kW	QD 24V 6 kW	QB 24V 9 kW
Idle	V	11	22.5
	< A	130	115
	> min ⁻¹	1200	3800
Short circuit	V	4	3
	A	740... 920	530... 710
		8	7
Torque	> Nm	75	62
		80	70
		85	70
Minimum voltage for solenoid switch	V	8	15
Commutator dia.	new mm	62	62
	minimum mm	59	59
Brush press.	N	14 ... 16	14 ... 16
Carbon-brush minimum length	mm	17.5	17.5
Armature longitudinal clearance	mm	24 ... 26	24 ... 26
Longitudinal clearance for pinion	mm	0.3	0.3
Armature longitudinal clearance	mm	-	-
Longitudinal clearance for drive spindle	mm	-	0.2 ... 0.3
Armature-return spring	N	50	50
Initial and final pressure	N	67	72

Continued on C5/C6



- 1 = Series winding
- 2 = Shunt winding
- 4 = Holding winding
- 5 = Auxiliary winding
- 10 = Solenoid switch
- 11 = Control relay
- 13 = Pull-in winding
- 17 = Tripping lever



C3

Test specifications
Starting motor 0 001 ..



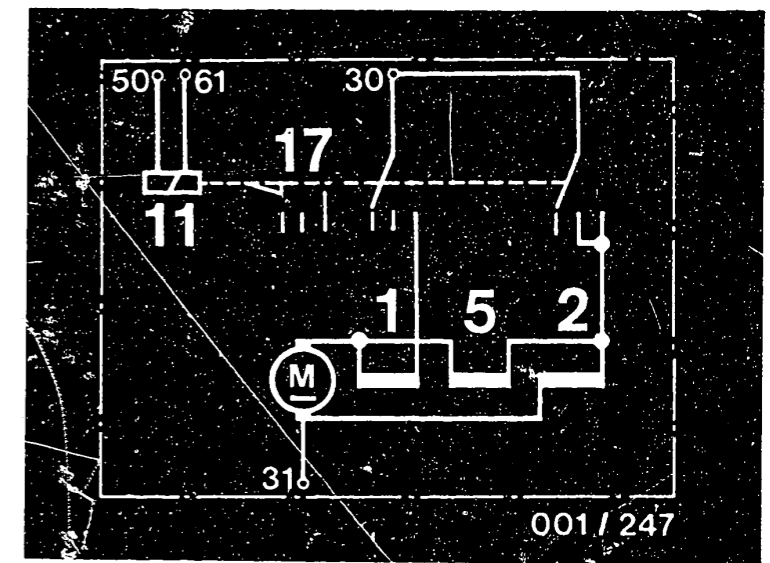
C4

Test specifications
Starting motor 0 001 ..

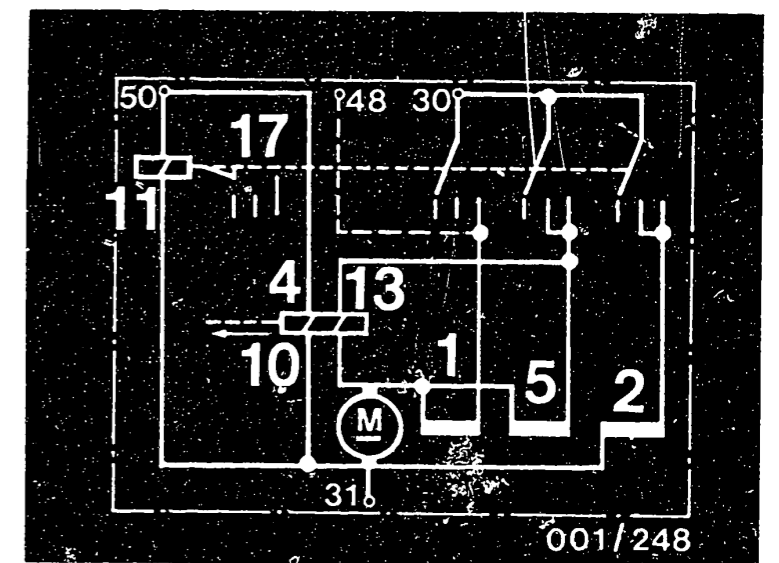


Continuation of C3/C4				
Part No.		0 001 500 ..	0 000 501 ..	0 001 510
Previous type code		QD 12V 3kW	QD 24V 6 kW	QB 24V 9 kW
Return spring for pinion and solenoid switch	N	-	-	35 ... 45
Initial and final pressure	N	-	-	66 ... 70
Tripping "b" relay	mm	15.8 ... 18.4	15.8 ... 18.4	-
Multi-plate clutch				
Overrunning torque	Nm	0.75 ... 1.05	0.75 ... 1.05	0.3 ... 0.5
Initial stage	Nm	0.6 ... 0.8	0.6 ... 0.8	-
Slip torque	Nm	140 ... 160	140 ... 160	180 ... 220 (200 ... 240) 1)
Backlash of teeth	mm	0.6 ... 0.8	0.6 ... 0.8	0.7 ... 0.9
Pinion clearance	mm	3.0 ... 4.0	3.0 ... 4.0	3.0 ... 4.0

1) As of FD 822/823



- 1 = Series winding
- 2 = Shunt winding
- 4 = Holding winding
- 5 = Auxiliary winding
- 10 = Solenoid switch
- 11 = Control relay
- 13 = Pull-in winding
- 17 = Tripping lever



C5

Test specifications

Starting motor 0 001 ..



C6

Test specifications

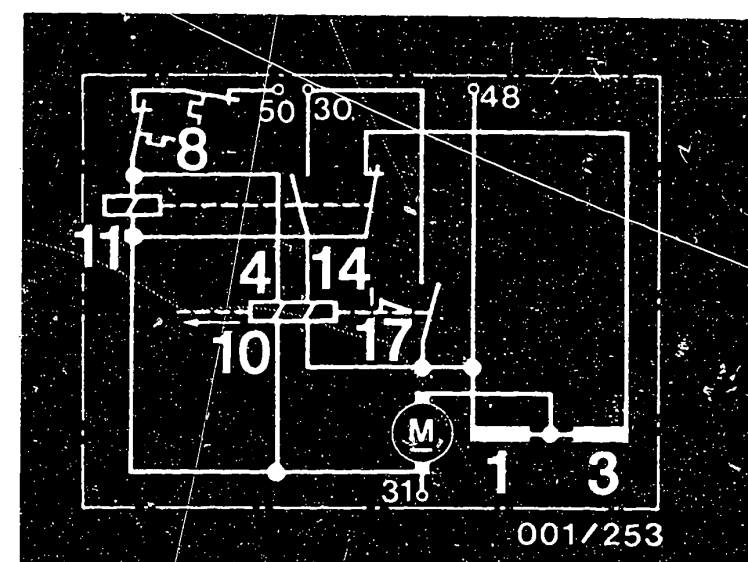
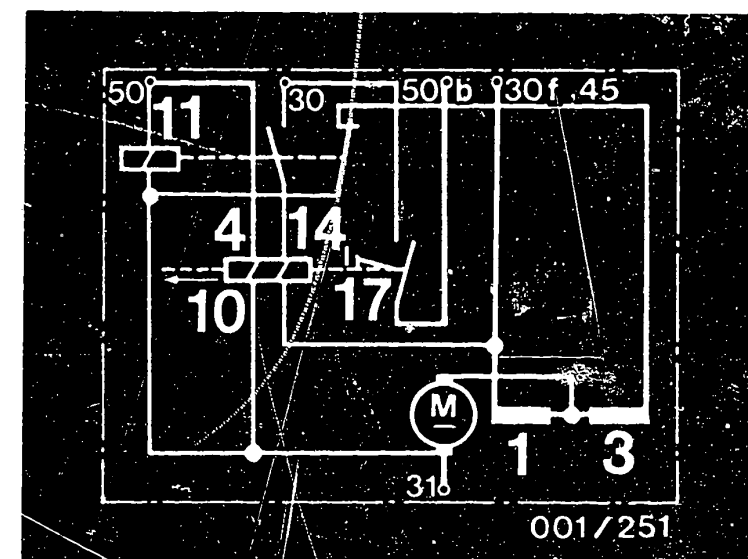
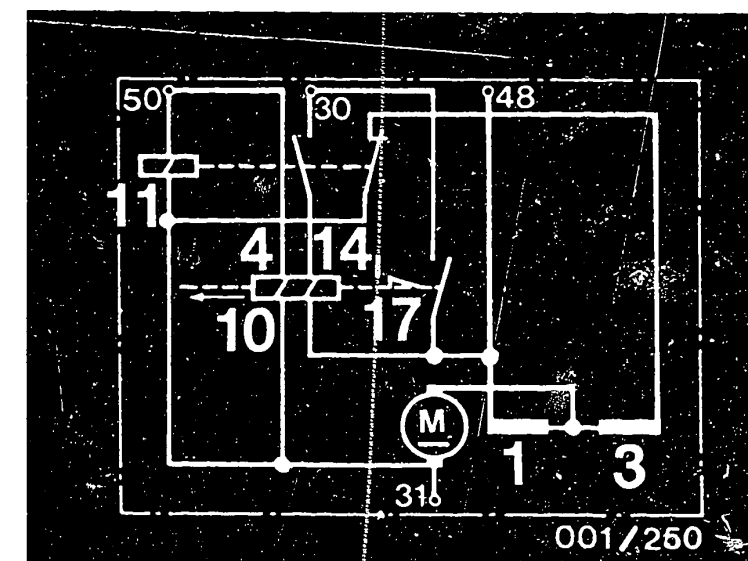
Starting motor 0 001 ..



Part no.		0 001 600 ..	0 001 601 ..	0 001 602 001	0 001 602 002				
Previous type code		TB 24V 10 kW	TB 24V 15 kW	TE 24V 10 kW	TE 24V 10 kW				
Idle	V	22.5	22.5	22.5	22.5				
	< A	115	170	115	115				
	> min ⁻¹	6000	6000	4100	4800				
Short circuit	V	8	7	5	4.5	8	7	8	7
	A	1400...	1200...	1700...	1510...	1400...	1220...	1400...	1220...
Torque	> Nm	1570	1380	1910	1730	1590	1400	1590	1400
		133	177	155	140	205	180	185	160
Minimum voltage for solenoid switch	V	14	12			14		14	
Commutator dia.	new mm			80					
	minimum mm			77					
Brush press.	N			13 ... 16					
Carbon-brush minimum length	mm			17					
Armature longitudinal clearance	mm			0.2 ... 0.4					
Longitudinal clearance for drive spindle	mm			0.5 ... 1.3					
Return spring for pinion and solenoid switch	N			70 ... 90					
Initial and final pressure	N			110 ... 130					
Multi-plate clutch									
Overrunning torque	Nm			0.6 ... 1.0					
Slip torque	Nm			300 ... 420					
Backlash of teeth	mm			0.7 ... 0.9					
Pinion clearance	mm			3.0 ... 4.5					

Legend for diagrams

- | | | |
|---------------------|----------------------|-----------------------------------|
| 1 = Series winding | 8 = Thermo-switch | 14 = Pull-in and opposing winding |
| 3 = Brake winding | 10 = Solenoid switch | 17 = Tripping lever |
| 4 = Holding winding | 11 = Control relay | |



C7

Test specifications

Starting motor 0 001 ..



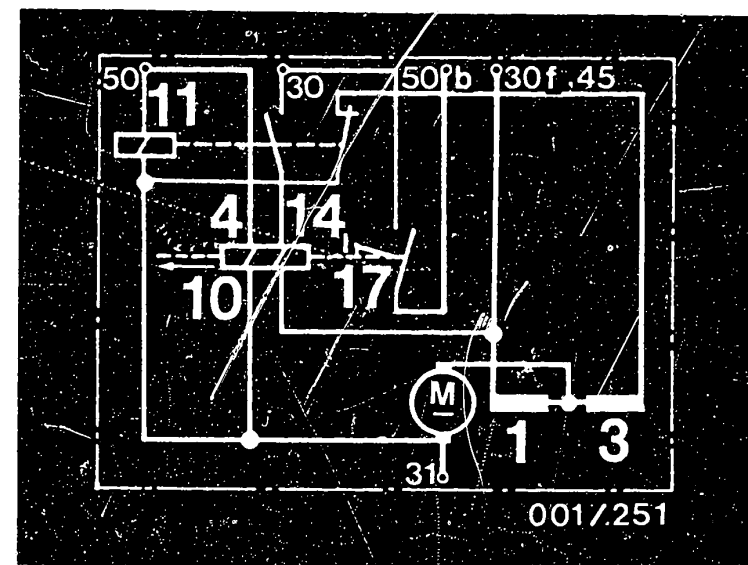
C8

Test specifications

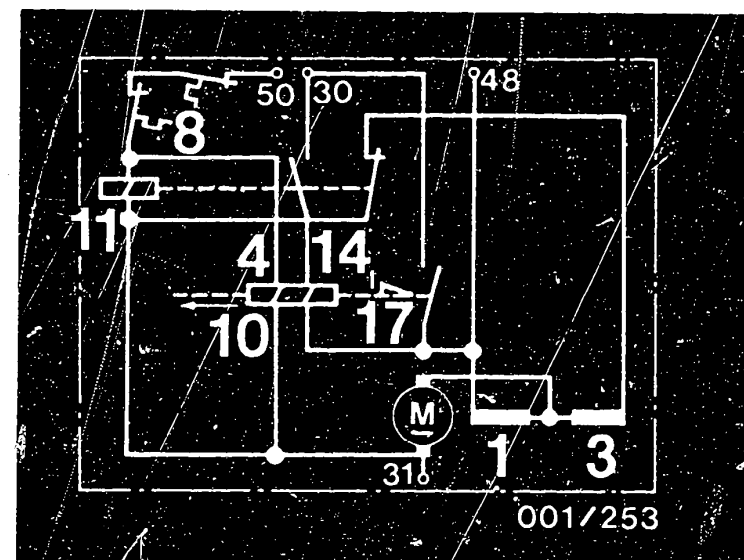
Starting motor 0 001 ..



Part no.	0 001 603 001	0 001 603 ..	0 001 608 ..	0 001 608 001
Previous type code	TE 24V 15 kW	TE 24V 15 kW	TF 24V 15 kW	TF 24V 15 kW
Idle	V	22	22	23
	< A	170	170	140
	> min ⁻¹	5800	4200	3700
Short circuit	V	5	4.5	5
	A	1700... 1910	1510... 1730	1700... 1910
Torque	> Nm	145	130	140
				126
Minimum voltage for solenoid switch	V	14	14	12
Commutator dia.	new mm	80	80	80
	minimum mm	77	77	77
Brush press.	N	13 ... 16	13 ... 16	13 ... 16
Carbon-brush minimum length	mm	17	17	17
Armature longitudinal clearance	mm	0.2 ... 0.4	0.2 ... 0.4	0.2 ... 0.4
Longitudinal clearance for drive spindle	mm	0.5 ... 1.3	0.5 ... 1.3	0.5 ... 1.3
Return spring for pinion and solenoid switch	N	70 ... 90	70 ... 90	70 ... 90
Initial and final pressure	N	110 ... 130	110 ... 130	110 ... 130
Multi-plate clutch				
Overrunning torque	Nm	0.6 ... 1.0	0.6 ... 1.0	0.8 ... 1.8
Slip torque	Nm	300 ... 420	320 ... 420	320 ... 420
Backlash of teeth	mm	0.7 ... 0.9	0.7 ... 0.9	0.7 ... 0.9
Pinion clearance	mm	3.0 ... 4.0	3.0 ... 4.0	3.0 ... 4.0



- 1 = Series winding
- 3 = Brake winding
- 4 = Holding winding
- 8 = Thermo-switch
- 10 = Solenoid switch
- 11 = Control relay
- 14 = Pull-in and opposing winding
- 17 = Tripping lever



C9

Test specifications

Starting motor 0 001 ..



C10

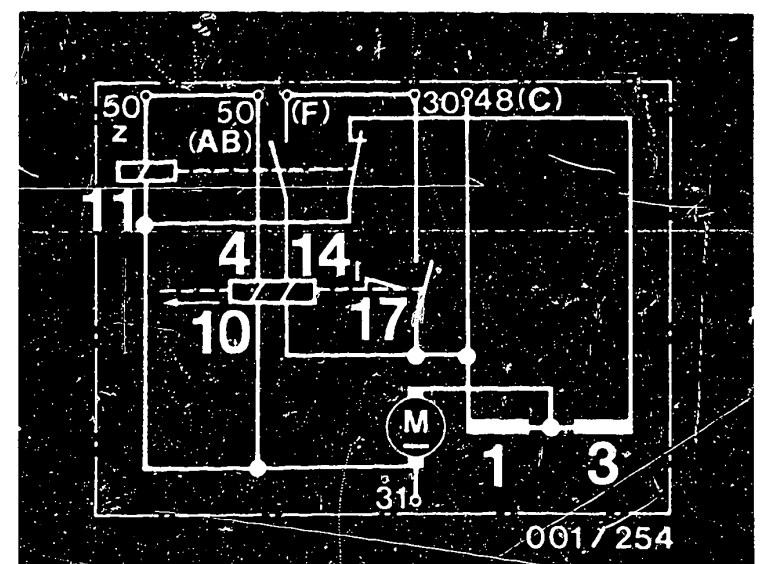
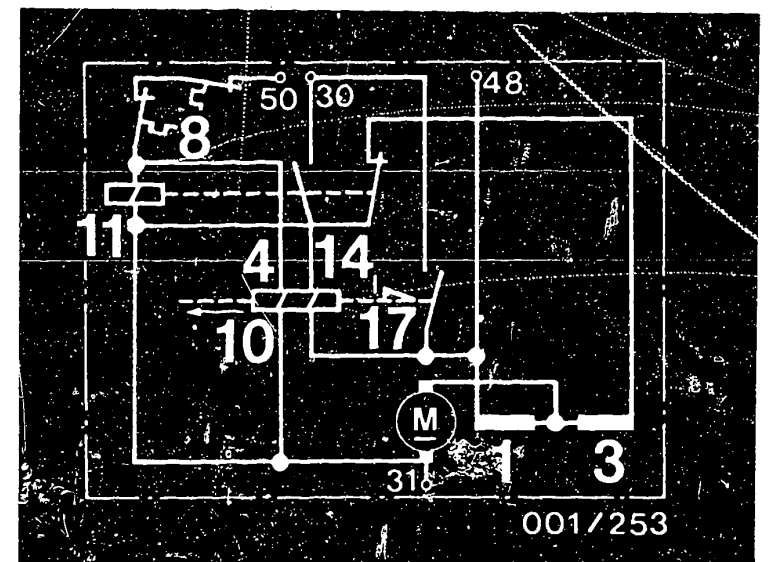
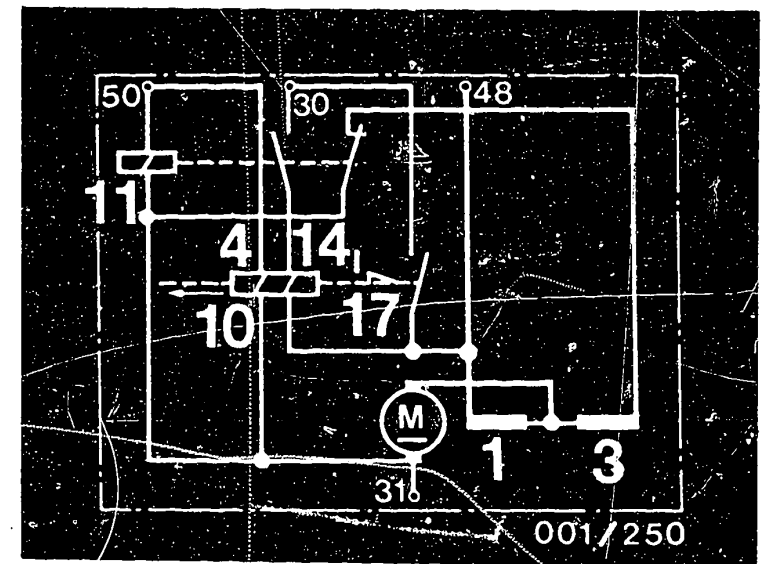
Test specifications

Starting motor 0 001 ..



Part no.		0 001 608 002 ... 003 ... 005	0 001 608 004 .. 006 .. 007	0001 611 ..	0 001 613 ..			
Previous type code		TF 24V 15 kW	TF 24V 15 kW	TF 24V 10 kW	TF 24V 18 kW			
Idle	V	23	23	23	23			
	< A	140	140	130	210			
	> min ⁻¹	3700	6000	4000	4900			
Short circuit	V	5	4.5	5	4.5	8	7	9
	A	1680... 1880	1500... 1700	1700... 1900	1530... 1730	1380... 1580	1200... 1400	< 3300
Torque	> Nm	225	200	146	130	195	170	280
Minimum voltage for solenoid switch	V	12		12		13		13
Commutator dia.	new mm	80		80		80		80
	minimum mm	77		77		77		77
Brush press.	N	13 ... 16		13 ... 16		13 ... 16		14 ... 15
Carbon-brush minimum length	mm	17		17		17		17
Armature longitudinal clearance	mm	0.2 ... 0.4		0.2 ... 0.4		0.2 ... 0.4		0.2 ... 0.4
Longitudinal clearance for drive spindle	mm	0.5 ... 1.3		0.5 ... 1.3		0.5 ... 1.3		0.5 ... 1.3
Return spring for pinion and solenoid switch	N	70 ... 90		70 ... 90		70 ... 90		70 ... 90
Initial and final pressure	N	110 ... 130		110 ... 130		110 ... 130		110 ... 130

Continued on C13/C14



C11

Test specifications

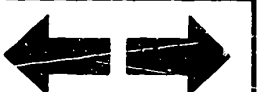
Starting motor 0 001 ..



C12

Test specifications

Starting motor 0 001 ..



Continuation of C11/12				
Part No.	0 001 608 002 ... 003 ... 005	0 001 608 004 ... 006 ... 007	0 001 611 ..	0 001 613..
Previous type code	TF 24V 15 kW	TF 24V 15 kW	TF 24V 10 kW	TF 24V 18 kW
Multi-plate clutch			0.6 ... 1.0	
Overrunning torque	Nm 0.6 ... 1.0		(0.8 ... 1.0) ¹⁾	0.6 ... 1.0
Slip torque	Nm 320 ... 420		320 ... 420	420 ... 500
Backlash of teeth	mm 0.7 ... 0.9		0.7 ... 0.9	0.7 ... 0.9
Pinion clearance	mm 3.0 ... 4.0		3.0 ... 4.0	3.0 ... 4.0

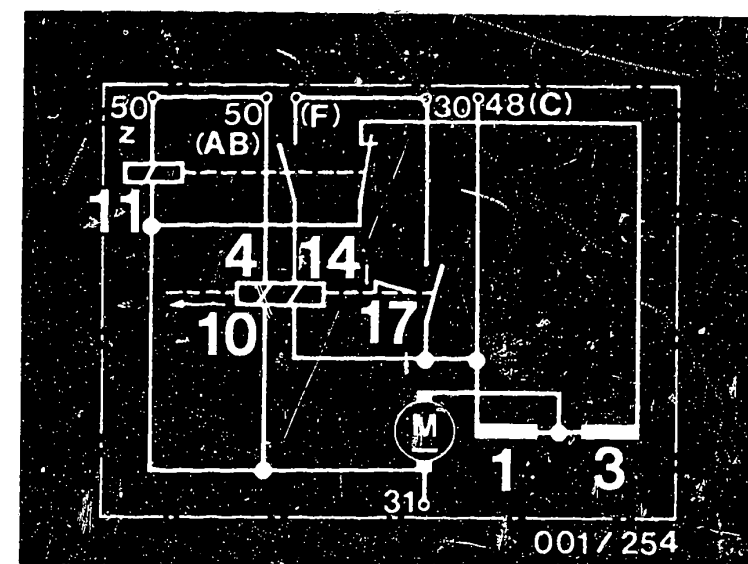
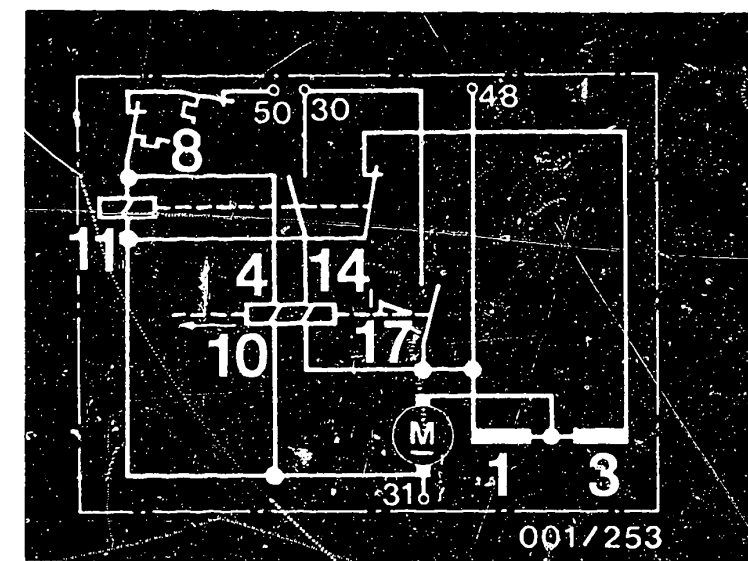
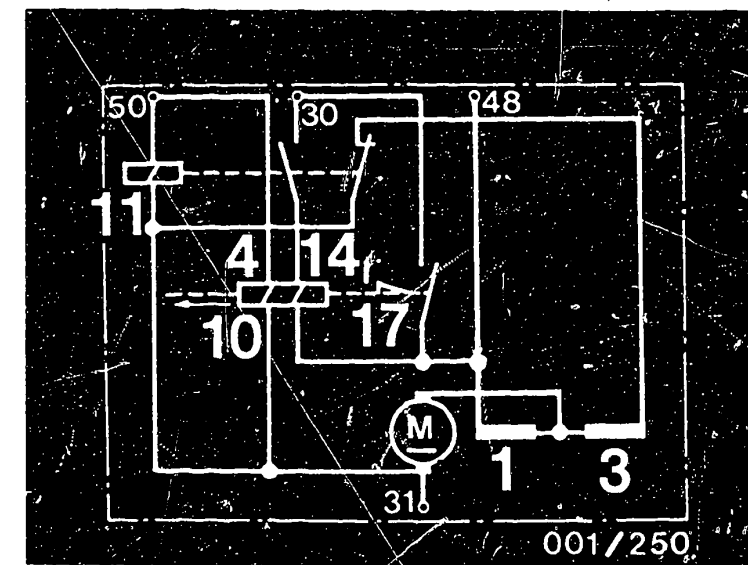
1) With built-in drive

Legends for diagrams

1 = Series winding
3 = Break winding

4 = Holding winding
8 = Thermo-switch
10 = Solenoid switch

11 = Control relay
14 = Pull-in and opposing winding
17 = Tripping lever



C13

Test specifications
Starting motor 0 001 ..

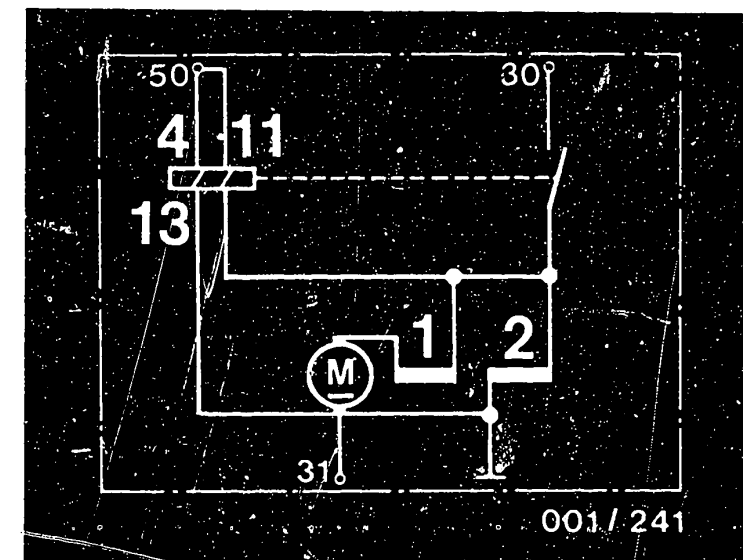


C14

Test specifications
Starting motor 0 001 ..



Part no.	0 001 370 .. 1)		0 001 371 ..		
Previous type code	JE 12V 5.5 kW		JE 24V		
Idle	V	11.5		23,5	
	< A	280		150	
	> min ⁻¹	6500		6500	
Short circuit	V	4.5	5.0	11	10
	A	<2200	<2400	< 1800	<1650
Torque	> Nm	54	60	100	85
Minimum voltage for solenoid switch	V	8		16	
Commutator dia.	new mm	45			
	minimum mm	42.5			
Brush press.	N	47 ... 53			
Carbon-brush minimum length	mm	17.5			
Armature longitudinal clearance	mm	0.1 ... 0.4			
Backlash of teeth	mm	0.6 ... 0.9			
Pinion clearance	mm	2.5 ... 4.0			



- 1 = Series winding
- 2 = Shunt winding
- 4 = Holding winding
- 11 = Pull-in winding
- 13 = Solenoid switch

1) Testing with parallel-connected batteries

C15

Test specifications
Starting motor 0 001 ..

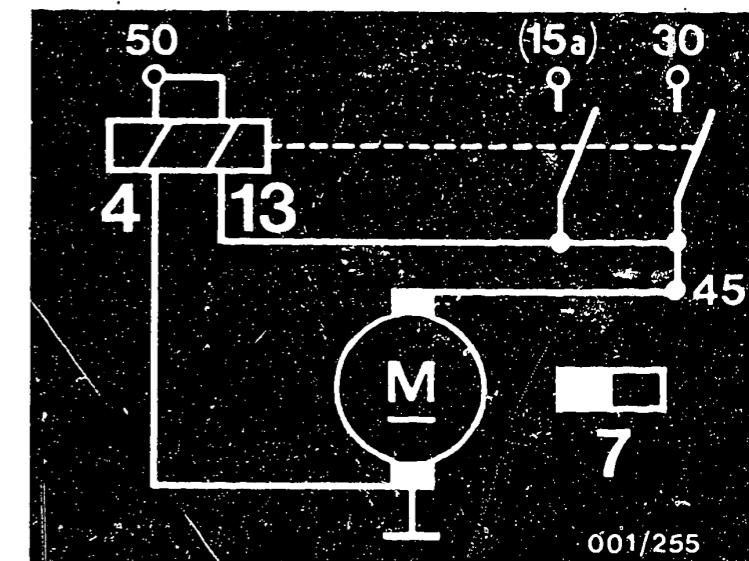


C16

Test specifications
Starting motor 0 001 ..



Part no.		0 001 111 ..	0 001 112 ..	0 001 113 ..	0 001 114 ..				
Previous type code		DW24V1.6 kW	DM12V0.9kW	DM12V0.8kW	DM2V1.0kW				
Idle	V	23	11.5	11.5	11.4				
	< A	40	45	45	50				
	> min ⁻¹	2800	5500	5000	5000				
Short circuit	V	12 ¹⁾	14 ¹⁾	5.7 ²⁾	6.7 ²⁾	5.7 ²⁾	6.7 ²⁾	5.2 ²⁾	6.2 ²⁾
	A	450...	550...	350...	400...	350...	400...	400...	450...
Torque	> Nm	25	28	7.0	8.0	6.0	7.0	7.5	8.5
	Minimum voltage for solenoid switch	V	18	8 3) 7.3 ⁴⁾	8 3) 7.3 4)	8 3) 7.3 ⁴⁾			
Commutator dia.	new mm		32.3		35.0				
	minimum mm		31.2		33.5				
Brush press.	N		-		-				
Carbon-brush minimum length	mm		4.5		3.0				
Armature longitudinal clearance	mm		0.05 - 0.4		0.05 - 0.4				
Armature braking torque	Nm		0.9 - 1.4		0.3.. 0.4				
Overrunning torque, Overrunning clutch	Nm		0.12 - 0.18		0.12 - 0.18				
Backlash of teeth	mm		0.3 - 0.6		0.3 - 0.6				
Pinion clearance	mm		2.0 - 3.0		2.0 - 3.0				



- 2 = Solenoid switch
- 3 = Permanent magnets
- 4 = Holding winding
- 13 = Pull-in winding

- 1) Testing with 2 x 143 Ah in series with 10 mΩ series resistor
- 2) Testing with 2 x 143 Ah parallel with 10 mΩ series resistor (EFAL 152/153 connection 30/2)
- 3) Test specification for relay 0 331 303 505, .. 563
- 4) Test specification for relay 0 331 302 553, .. 559

Note:

Do not operate 12 V starting motor (DW) with 24 V, as this will destroy the starting motor.

C17

Test specifications

Starting motor 0 001 ..



C18

Test specifications

Starting motor 0 001 ..



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218 ..	A 22
304 ..	A 22
305 ..	A 22
306 ..	B 1
307 ..	B 1
308 ..	B 1
310 ..	B 3
311 ..	B 3
311 1..	B 5
312 ..	B 5
313 ..	B 5



Table of contents (continued)

<u>Starting-motor part number:</u>	<u>Coordinates</u>
0 001 314 ..	B 7
315 ..	B 7
316 ..	B 7
317 ..	B 7
354 ..	B 9
355 ..	B 9
356 ..	B 9
358 ..	B 9
358 2..	B 11
359 ..	B 11
360 ..	B 11
360 026	B 13
362 ..	B 13
363 ..	B 13
364 ..	B 15
365 ..	B 15
366 ..	B 15
367 ..	B 17
368 ..	B 17
370 ..	C 15
371 ..	C 15
400 ..	B 19
401 ..	B 19
402 ..	B 19



Table of contents (continued)

<u>Starting-motor part number:</u>	<u>Coordinates</u>
0 001 410 ..	B 21
411 ..	B 21
412 ..	B 21
413 ..	B 23
414 ..	B 23
416 ..	B 23
417 ..	C 1
418 ..	C 1
420 ..	C 1
421 ..	C 1
500 ..	C 3
501 ..	C 3
510 ..	C 3
600 ..	C 7
601 ..	C 7
602 ..	C 7
603 ..	C 9
608 ..	C 9
608 ..	C 11
611 ..	C 11
613 ..	C 11



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